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CONTENTS OF No. 152.

	PAGE
The Chemistry of Cookery. XLIII.—The Cookery of Wine. By W. Mattieu Williams	249
The Electro-Magnet. (*Illus.*) By W. Slingo	250
Flight of a Missile. (*Illus.*) By Richard A. Proctor	252
Education	253
The Entomology of a Pond. By E. A. Butler	253
Notes on Coal. By R. A. Proctor	255
Other Worlds than Ours. By M. de Fontenelle. With Notes by Richard A. Proctor	256
Dickens's Story Left Half Told. By Thomas Foster	257
Post-Mortem Attitudes. (*Illus.*)	258
The International Health Exhibition. XVII. (*Illus.*)	260
Editorial Gossip	261
Reviews:— Bible Folk-Lore. By Edward Clodd	262
Some Books on Our Table	263
Face of the Sky. By F.R.A.S.	265
Correspondence:— Tea-Drinking—Mind and Brain, &c.	265
Our Chess Column	268

THE CHEMISTRY OF COOKERY.

By W. MATTIEU WILLIAMS.

XLIII.—THE COOKERY OF WINE.

IN an unguarded moment I promised to include the above in this series, and will do the best I can to fulfil the promise; but the utmost result of this effort can only be a contribution to the subject which is too profoundly mysterious to be fully grasped by any intellect that is not sufficiently clairvoyant to penetrate paving-stones and see through them to the interiors of the closely-tiled cellars wherein the mysteries are manipulated.

I will first define what I mean by the cookery of wine. Grape juice in its unfermented state may be described as "raw wine," or this name may be applied to the juice after fermentation. I apply it in the latter sense, and shall use it as describing grape juice which has been spontaneously and recently fermented without the addition of any foreign materials, or altered by keeping, or heating, or any other process beyond fermentation. All such processes and admixture which affect any chemical changes on the raw material I shall describe as cookery, and the result as cooked wine. When wine made from other juice than that of the grape is referred to it will be named specifically.

At the outset a fallacy, very prevalent in this country, should be controverted. The high prices charged for the cooked material sold to Englishmen has led to absurdly exaggerated notions of the original value of wine. I am quite safe in stating that the average market value of rich wine in its raw state, in countries where the grape grows luxuriantly, and where, in consequence, the average quality of the wine is the best, does not exceed sixpence per gallon, or one penny per bottle. I speak now of the newly-made wine. Allowing another sixpence per gallon for barrelling and storage, the value of the commodity in portable form becomes twopence per bottle. I am not speaking of thin, poor wines, produced by a second or third pressing of the grapes, but of the best and richest quality, and, of course, I do not include the fancy wines, those produced in certain vineyards of celebrated châteaux, that are superstitiously venerated by those easily-deluded people who suppose themselves to be connoisseurs of choice wines. I refer to the ninety-nine and nine-tenths per cent. of the *rich* wines that actually come into the market. Wines made from grapes grown in unfavourable climates naturally cost more in proportion to the poorness of the yield.

As some of my readers may be inclined to question this estimate of average cost, a few illustrative facts may be named. In Sicily and Calabria I usually paid at the roadside or village "osterias" an equivalent to one halfpenny for a glass or tumbler holding nearly half-a-pint of common wine, thin but genuine. This was at the rate of less than one shilling per gallon, or twopence per bottle, and included the cost of barrelling, storage, and inn-keeper's profit on retailing. In the luxuriant wine-growing regions of Spain, a traveller halting at a railway refreshment station and buying one of the sausage sandwiches that there prevail, is allowed to help himself to wine to drink on the spot without charge, but if he fills his flask to carry away, he is subjected to an extra charge of one halfpenny. It is well known to all concerned that at vintage-time of fairly good seasons, in all countries where the grape grows freely, a good cask is worth more than the new wine it contains when filled; that much wine is wasted from lack of vessels, and anybody sending two good empty casks to a vigneron, can have one of them filled in exchange for the other. Those who desire further illustrations and verification should ask their friends—*outside of the trade*—who have travelled in Southern wine countries, and know the language and something more of the country than is to be learned by being simply transferred from one hotel to another under the guidance of couriers, cicerone, valets de place, and other flunkies. Wine-merchants are "men of business."

Thus the five shillings paid for a bottle of rich port is made up of one penny for the original wine, one penny more for cost of storage, &c., about sixpence for duty and carriage to this country, and twopence for bottling, making tenpence altogether; the remaining four shillings and twopence is paid for cookery and wine-merchant's profits.

Under cookery I include those changes which may be obtained by simply exposing the wine to the action of the temperature of an ordinary cellar, or the higher temperature of "Pasteuring," to be presently described.

In the youthful days of chemistry the first of these methods of cookery was the only one available, and wine was kept by wine-merchants with purely commercial intent for a considerable number of years.

A little reflection will show that this simple and original cookery was very expensive, sufficiently so to legitimately explain the rise in market value from tenpence to five shillings or more per bottle.

Wine-merchants require a respectable profit on the capital they invest in their business—say ten per cent. per annum on the prime cost of the wine laid down. Then there is the rental of cellars and offices, the establishment expenses—such as wages, sampling, sending out, advertising, losses by bad debts, &c.—to be added. The capital lying dead in the cellar demands compound interest. At ten per cent. the principal doubles in about seven and one-third years. Calling it seven years, to allow very meagrely for establishment expenses, we get the following result:—

	£	s.	d.	
When 7 years old the tenpenny wine is worth	0	1	8	per bottle.
„ 14 „ „ „	0	3	4	„
„ 21 „ „ „	0	6	8	„
„ 28 „ „ „	0	13	4	„
„ 35 „ „ „	1	6	8	„

Here, then, we have a fair commercial explanation of

the high prices of old-fashioned old wines; or of what I may *now* call the "traditional value" of wine.

Of course, this is less when a man lays down his own wine in his own cellar in obedience to the maxim "Lay down good port in the days of your youth, and when you are old your friends will not forsake you." He may be satisfied with a much smaller rate of interest than the man engaged in business fairly demands. Still, when wine thus aged was thrown into the market, it competed with commercially cellared wine, and obtained remarkable prices, especially as it has a special value for "blending" purposes, *i.e.*, for mixing with newer wines and infecting them with its own senility.

But why do I say that *now* such values are traditional? Simply because the progress of chemistry has shown us how the changes resulting from years of cellarage may be effected by scientific cookery in a few hours or days. We are indebted to Pasteur for the most legitimate—I might say the only legitimate—method of doing this. The process is accordingly called "Pasteuring." It consists in simply heating the wine to the temperature of 60°C.=140° Fahr., the temperature at which, as will be remembered, the visible changes in the cookery of animal food commences. It is a process demanding considerable skill; no portion of the wine during its cookery must be raised above this temperature, yet all must reach it; nor must it be exposed to the air.

The apparatus designed by Rossignol is one of the best suited for this purpose. This is a large metallic vat or boiler with air-tight cover and a false bottom, from which rises a trumpet-shaped tube through the middle of the vat, and passing through an air-tight fitting in the cover. The chamber formed by the false bottom is filled with water by means of this tube, the object being to prevent the wine at the lower part from being heated directly by the fire which is below the water chamber. A thermometer is also inserted air-tight in the lid, with its bulb half-way down the vat. To allow for expansion a tube is similarly fitted into the lid. This is bent syphon-like, and its lower end dipped into a flask containing wine or water, so that air or vapour may escape and bubble through, but none enter. Even in drawing off from the Pasteuring vat into the cask the wine is not allowed to flow through the air, but is conveyed by a pipe which bends down, and dips to the bottom of the barrel.

If heated with exposure to air, the wine acquires a flavour easily recognised as the "goût de cuit," or flavour of cooking. By Pasteur's method, properly carried out, the only changes are those which would be otherwise produced by age.

These changes are somewhat obscure. One effect is probably that which more decidedly occurs in the maturing of whisky and other spirits distilled from grain—viz., the reduction of the proportion of amylic alcohol or fusel oil, which although less abundantly produced in the fermentation of grape juice than in grain or potato spirit, is formed in varying quantities. Caproic alcohol and caprylic alcohol are also produced by the fermentation of grape juice or the "marc" of grapes—*i.e.*, the mixture of the whole juice and the skins. These are acrid, ill-flavoured spirits, more conducive to headache than the ethylic alcohol, which is proper spirit of good wine. Every wine-drinker knows that the amount of headache obtainable from a given quantity of wine, or a given outlay of cash, varies with the sample, and this variation appears to be due to these supplementary alcohols or ethers.

Another change appears to be the formation of ethers having choice flavours and bouquets; *œnanthic ether*, or the ether of wine, is the most important of these, and it is probably formed by the action of the natural acid salts of the wine upon its alcohol. Johnstone says:—"So powerful is the odour of this substance, however, that few wines contain more than one-forty-thousandth part of their bulk of it. Yet it is always present, can always be recognised by its smell, and is one of the general characteristics of all grape wines." This ether is stated to be the basis of *Hungarian wine oil*, which, according to the same authority, has been sold for flavouring brandy at the rate of sixty-nine dollars per pound. I am surprised that up to the present time it has not been cheaply produced in large quantities. Chemical problems that appear far more difficult have been practically solved.

THE ELECTRO-MAGNET.

By W. Slingo.

(*Continued from p.* 175.)

AS I intimated in a previous article, an electro-magnet is not necessarily a straight one. In fact, it may be made to almost any pattern, although naturally the shape and dimensions should be kept within certain bounds to ensure the greatest attainable efficiency. Inasmuch as electro-magnets are rarely used except where transitory effects are requisite, they are generally made in one or other of the many possible modifications of the so-called horse-shoe shape. The object is to get the two poles near each other, so as to influence a piece of iron placed across

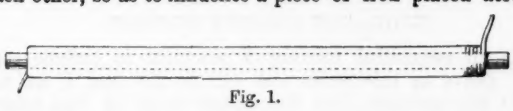


Fig. 1.

them. In Fig. 1 we have the general form of an elementary electro-magnet, in which one end of the iron core becomes a north pole and the other a south pole. It is manifest that if with this we wish to exert the greatest possible amount of attraction of which it is capable we must utilise the two polar forces. The piece of soft iron best adapted for this would be curved in shape, the segment of a circle with one extremity on each pole. This, however, would constitute an awkward armature, more especially where it is required to be light and capable of moving freely. When, therefore, it is permissible to utilise both poles of the electro-magnet, it is bent into a more or less perfect U shape. Fig. 2 represents

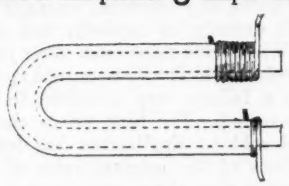


Fig. 2.

what we might get by bending a simple bar magnet. We rarely, however, see a horse-shoe-magnet so constructed. In the first place, a horse-shoe-magnet is manifestly only intended for use at close quarters, because at even a short distance, the two polarities become more nearly equidistant, and we very soon reach a point where they are practically equal, and where they, being opposite, neutralise each other. Now it will be remembered that in the preceding article it was demonstrated that when experimenting with bar magnets, a magnet wound as depicted in Fig. 3 gave greater results (at short distances)

than did a magnet wound as shown in Fig. 1, the quantity of wire and of iron being in each case identical. For this reason, then, even if no other were available, wire is not

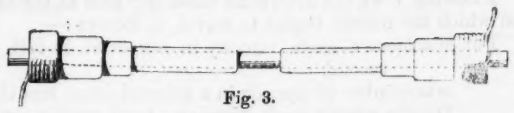


Fig. 3.

wound over the bend of the core. This applies almost as forcibly when the wire is wound evenly over the two ends of the core, the centre remaining bare, as shown in Fig. 4 (where A represents the soft iron armature). Another, although, perhaps, a less important reason for not covering the centre of the bent core is the difficulty that would be experienced in winding, on account of the larger surface on the outside as compared with the inside of the bend, a difference which would obviously increase with every additional layer of wire.

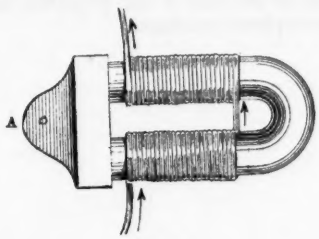


Fig. 4.

Unless the armature is particularly small, the two "legs" of the electro-magnet are rarely bent so as to make the poles approach each other, as in the case of permanent steel magnets. They are simply bent parallel, great care being taken to ensure the greatest degree of softness. The core of an electro-magnet should never be of steel, or even of hard cast-iron, because of the much lower magnetic capacity these materials possess as compared with good, soft iron. In hammering a piece of iron rod to form the bent core, there is a strong tendency to hardening, and as little hammering as possible should be resorted to, the bend being more efficiently produced by heating the iron to redness, when the metal becomes, naturally, much more workable. In any case, after the proper shape has been attained, the iron should be heated to redness, embedded in charcoal or placed in a clear fire, and then withdrawn and allowed to cool gradually, or, better still, left in the fire until it dies right out. The greatest efficiency at short distances is produced when the wire is coned towards the extremities—in fact, when the magnet has the appearance of being a bent form of that shown in Fig. 3.

As stated above, electro-magnets are not often called into requisition when only a single pole is required. When such a magnet, however, is necessary, it is well to use a long core, winding the given quantity of wire over one end of it, as shown in Fig. 5. The reason for this is, that a

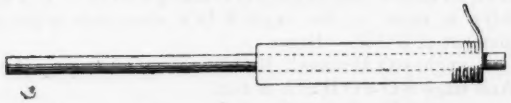


Fig. 5.

greater magnetic concentration is produced, or, in other words, the poles are separated by a greater distance, and the one to be used is therefore counteracted to a much less degree by the more distant opposite pole. It must not be forgotten that while the one end is inducing one condition in a neighbouring piece of iron, the opposite end is producing exactly the opposite state of affairs, and the resulting condition of the iron is an expression of the difference between the two inductive tendencies.

This fact may easily be demonstrated by passing a current through a coil of wire over, say, a thin 6-in. rod of iron, and after noting the strength, place the coil over the small end of a poker and again passing the current through it. If the quality of the iron and other conditions are identical, the poker will show a much greater effect than the short piece of iron. A coil or bobbin of wire for these experiments may be easily made. Procure a sheet of rather stout foolscap or other paper, and laying it on a hard, smooth surface, such as that of a drawing-board, place a ruler or other cylindrical rod about three quarters of an inch in diameter across one end of it. Then roll the paper tightly round the rod *once*, and gum thoroughly the remainder of the upper surface of the paper. Next roll the whole sheet over the rod, squeezing as much gum as possible into the pores of the paper, and forcing out any that may remain unabsorbed. When the sheet is fully wound, secure it with string, and place it on one side for an hour or two, letting it dry thoroughly. When assured that it is dry, press two cardboard or thin wooden discs, about three inches in diameter, over the ends of the paper cylinder. I have found cardboard answer very well. It may be made rigid by binding a little string round the cylinder, *outside* the cardboard, and then saturating the string more or less completely with gum, wax, &c. When this is done, remove the string which was used to hold the paper together, and withdraw the ruler. The result will be a thin but very rigid tube, with an excellently smooth inner surface. The space between the discs or cheeks may next be filled with five or six layers of stout, cotton-covered, copper wire, care being taken to insure that the winding is continuous, as previously pointed out. The winding should be done as carefully and evenly as possible. Kinks and bends in copper wire may be readily removed. If allowed to remain they give to the coil an unsightly appearance, besides uselessly taking up valuable space. Of course, the two ends of the wire should be brought out. The inner one may be passed through a small hole in one of the cheeks near the cylinder. When finished, soak the coil thoroughly, in melted paraffin wax to insure insulation, to maintain rigidity, and to exclude moisture. The appearance of the coil may be improved by painting it with sealing-wax varnish, which may be made by dissolving some shellac in methylated spirit, and adding a very small quantity of vermilion to the solution. For the present purpose the varnish may be made by dissolving a little ordinary sealing-wax in the spirit, although the common wax is not to be so highly commended for insulating purposes.

Such electro-magnets as the one illustrated in Fig. 4 are almost invariably adopted for electric bells and other similar purposes; but in telegraphic and kindred apparatus another plan is resorted to, a reference to which we must defer for a fortnight.

Melted Lead in the Eye.—A curious case of accident from a fragment of melted lead solidifying on the surface of the eye without injuring it was recently brought before the Bordeaux Society of Anatomy and Physiology by Dr. Perrier, who showed that the immunity of the eye from burning was really due to the "spheroidal state." The melted jet of lead was at a higher temperature than 171° Cent., the temperature necessary to produce the spheroidal state; hence, when it arrived at the surface of the eye it vaporised the moisture of the latter. When it had cooled below 171° Cent. the lachrymal secretion prevented the metal from scorching the ball.

FLIGHT OF A MISSILE.

By Richard A. Proctor.

I HAVE been asked whether the method by which I treated the movement of a body projected vertically from a point on the equator—regarding such a body, from the moment when its flight began, as moving in space under the attraction of the earth, and therefore in obedience to Kepler's laws—can be extended to any missile projected in any direction from any part of the earth's surface. I see no reason why the method should fail, or even why there should be any difficulty in applying it. Let us, however, inquire.

Let O, the point from which a missile is projected, lie in latitude λ, and let O X be part of a latitude-parallel and O Y part of the meridian ; O Z vertical.

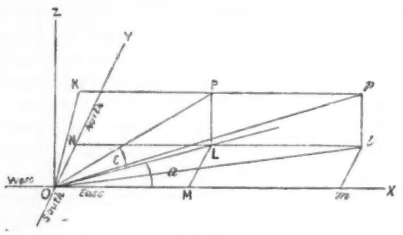


Fig. 1.

Suppose the missile to be projected from O in direction O P with velocity v, at an elevation ϵ ; and draw P L perpendicular to the plane Y X (part of the earth's surface, appreciably, near O) join O L, and draw L M, L N perpendicular to O X and O Y respectively. Let angle L O X = a.

Suppose now that the length O P represents the velocity v ; then P L represents the vertical velocity of the missile, or $v \sin \epsilon$; O L represents the horizontal velocity, or $v \cos \epsilon$; O M is the velocity in direction O X, or $v \cos \epsilon \cos a$; and O N is the velocity in direction O Y or $v \cos \epsilon \sin a$. But we have to consider also the velocity in direction O X on account of the earth's motion of rotation, which the missile shares with the earth's surface at the moment of projection, and retains thereafter, subject of course to such influences as may thereafter be brought to bear on it. Call this velocity u for convenience (we know that it is represented by the circumference of the parallel of latitude though O divided by the period of rotation, or is $2 \pi r \cos \lambda \div P$, where r is the radius of the earth in feet and P the number of seconds in a sidereal day). Then if we represent u by M m, O m represents the true velocity of the missile in direction O X, or $v \cos \epsilon \cos a + u$.

Complete the parallelogram O N l m, draw l p parallel and equal to L P, and join O p, then O p represents the actual velocity of the missile in space, referred to the earth's centre. (Of course the missile shares the motion of the earth around the sun, of the solar system in space, &c., &c., but in considering its flight above the earth's surface we need take no account of these parts of its motion). Call this velocity V.

Join p P which is parallel to U and produce to meet the plane Z Y in K and join O K ; then since p K is parallel to l N, it is at right angles to the plane Z Y and O K p is a right angle. Hence $Op^2 = OP^2 + Pp^2 + 2\,P\,p.PK$ or

$$V^2 = v^2 + u^2 + 2uv \cos \epsilon \cos a.$$

This gives us the actual velocity of the missile. We know its actual inclination to the earth's surface, *viz.* the angle p O l, from the relation

$$\sin p\,O\,l = \frac{p\,l}{O\,p} = \frac{v \sin \epsilon}{\sqrt{v^2 + u^2 + 2\,u\,v \cos \epsilon \cos a}} = \frac{v \sin \epsilon}{V}$$

Knowing V we can determine the major axis of the orbit on which the missile begins to travel, as follows :—

Put M = moon's mean velocity in her orbit, in feet per second.

m = number of seconds in a sidereal lunar month.

D = the moon's mean distance } from earth's centre,

d = missile's mean distance } in feet.

Then by a well-known corollary from Kepler's third law, we have

$$d : D :: V^2 : M^2$$

and

$$M = \frac{2\pi D}{m}$$

Thus

$$d = \frac{DV^2}{M^2} = \frac{(v^2 + u^2 + 2\,u\,v \cos \epsilon \cos a)m^2}{4\pi^2 D}$$

Hence we have all the details necessary for the precise determination of the path of our projectile, neglecting the effects of atmospheric resistance.

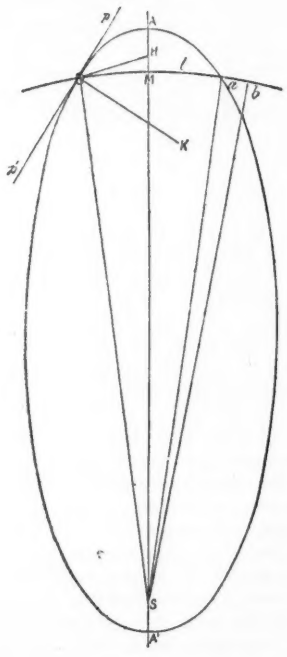


Fig. 2.

Thus, suppose we have in Fig. 2 a section through the earth's centre and the line O l of Fig. 1. Let S be the earth's centre, O p the true course of the missile (O p of Fig. 1). Join O S, produce p O to p', and draw O K perpendicular to $p\,p'$. Then as S is one focus of the elliptical orbit O A A′ of the missile, the other focus lies in direction O H, so drawn that angle p O H = angle S O p'. But angle S O p' is equal to the angle K O M since each is the complement of S O K. Hence

angle p O H = angle K O M = comp. of angle p O M.

And since S O + O H = A A′ = 2d

$$O\,H = 2\,d - S\,O = 2\,d - \text{earth's radius} = 2\,d - r$$

$$= \frac{(v^2 + u^2 + 2\,u\,v \cos \epsilon \cos a)m^2}{2\,\pi^2\,D} - r$$

This assigns the position of H ; and H S being thus given, while A A′ is known, we have the position of A, and the whole of the path O A a.

Having, however, thus shown that, given the velocity and elevation of a particle and the latitude of the point of projection, the actual path (apart from atmospheric resistance) may be dealt with precisely like the path of a body in space around a centre of attraction, I forbear to deal thus with any given example, simply because there would be no particular use in working out a problem of the sort. The student who cares to do so may thus deal with such a problem, noting that D and m are given in all tables of lunar elements, r is known, u for a given latitude is also known, while v and ϵ are supposed to be given.

(*To be continued.*)

EDUCATION.

AT no period of our national history has education assumed the vital importance which now attaches to it. Compulsory as it now is in every rank of life, the man who would even hold his own in the present day cannot, and must not, be contented with the acquisition of the minimum of knowledge; for assuredly the "survival of the fittest" in the immediate future means that of the possessor of the most varied and best-digested information. We write at the beginning of the educational year, when many hundreds or thousands of young men are commencing a career at the Universities, hospitals, &c., &c., which is either to make or mar them; to produce citizens who shall contribute to the honour, dignity, and intellectual and material advancement of their native land; or to turn out failures, who can only act as a clog and a dead-weight upon it. That the study of the classics, with that refining influence which they have exercised upon so many generations of English gentlemen, and of mathematics, with the incomparable mental gymnastics which they supply, will ever be superseded as essentials, it would be idle to suppose. What, though, we would insist upon here is the paramount necessity of supplementing them by a competent acquaintance with natural and physical science. No man, towards the end of this nineteenth century, can be said to be "throughly furnished" who is unfamiliar with the most recent results in physics and biology; for the value of a knowledge of science can hardly be over-estimated. In its very lowest aspect, the power it confers of increasing our material prosperity might well commend it to those whose first question would be, "Does it pay?" But for its application to mechanical and industrial pursuits we could assuredly never have attained that proud pre-eminence among nations which is the glory of every patriotic Englishman. In a higher point of view, though, the earnest student will appreciate the benefits it confers, not only as a means of mental training, but for the habit of mind which it induces of loving truth for its own sake, and humbly pursuing it in the confidence that whithersoever it may lead us, it will be into safe and pleasant pastures. And, in the highest point of view, is not the theologian more indebted to science than he is unfortunately always willing to confess? No one can fail to contrast the ancient view of the Deity as (what Matthew Arnold calls) "a magnified, non-natural man," a mere tribal ruler, with the immeasurably enlarged conception of the Almighty Lord of the universe enjoyed by the modern student of astronomy, who stands humbled and appalled before majesty so infinite, that he trembles at the very conception of it. If, then, we have not claimed too much for science as an essential element in education—as assuredly we have not—we need not reiterate our earnest advice to the student by no means to neglect it. Even as a means of recreation, he will find it delightful. We are the more encouraged to urge this from the success which our own endeavours to present sound and accurate scientific information—"plainly worded and exactly described"—have met with. From Canada, from New Zealand, from Burmah, from South America, and from the Cape do we receive testimony that our efforts to popularise the knowledge of nature is appreciated. We would fain hope that our fellow countrymen at home may learn widely to value such knowledge, too; and by sedulous study of the marvels by which they are surrounded, supply themselves with one of the most potent weapons available in the battle of life.

THE ENTOMOLOGY OF A POND.

By E. A. Butler.

THE BOTTOM (*continued*).

SCATTERED about here and there over the bottom of a clear pond may often be seen a number of dark and more or less cylindrical objects lying horizontally. A little watching will reveal the fact that they are living, for they will be seen slowly moving about over the bottom, and, perhaps, presently climbing the stem of some aquatic plant. Fishing some out with a net, we find that each consists of a cylindrical tube made of various materials, and inhabited by a sort of caterpillar furnished with six legs on the anterior part of its body. They are caddis-worms, or case-worms, but, notwithstanding the name, they have only a very remote connection with the true worms, being the larval forms of the order *Trichoptera*, *i.e.*, the caddis-flies or water-moths.

It is not an easy matter to extract the living occupant from its abode by mere pulling, though it is not in any way attached thereto. In such an animal as a snail, whelk, or winkle the difficulty of extracting the mollusc arises from the fact that it is fastened by strong muscular adhesion to the shell it constructs, but the caddis larva, like the marine tube-worms, merely builds up a case round itself for protection, and is not in any way organically united with it. But by means of certain hooks at the end of its body, it can, like a hermit crab with the molluscan shell it has appropriated, resist very successfully any attempts to drag it forth, and will even suffer itself to be pulled in twain rather than relax its hold. An application of boiling-water, however, at once kills the little tenant, and we can then easily draw out its corpse and examine the case at leisure. Should it be desired to extract the animal alive, it must be attacked from the rear. The case is open at both ends, the hinder aperture being the smaller of the two. The head of a pin inserted at this opening and pushed gently forward will so startle the grub as to cause it to relax its hold and advance a little in the tube; a few more gentle "prods" from behind and it completely evacuates its fortress, without damage to itself or injury to its case, into which it will be ready to return at the first opportunity. On slitting open the case we find that the inside is beautifully lined with a tough, thin, papery substance, which is smooth enough, whatever may be the irregularities outside. This material, like the silk of the silkworm, is produced by the insect as a gummy secretion which hardens immediately on exposure.

The nature of the external adornment will depend upon the species we have secured, and upon the materials that may happen to have been obtainable by the larva. Small bits of stick, rushes, roots, or fibres, blackened by long soaking in the water, and completely water-logged, grains

of sand or small stones, the leaves of trees or fragments of aquatic vegetation, the seeds of rushes or other plants growing by the water side, and the shells of fresh-water mollusca, both dead and living—these are some of the principal materials employed, their exact nature and arrangement being different in different species, and sometimes in the same species at different ages. Some will cut little shreds of vegetable matter, all of the same length, and arrange them side by side in a spiral manner with wonderful regularity; others will take whole leaves of poplar, willow, and other trees, and attach them flatly to the case. Some will select small stones, and stick them on with great dexterity, forming a tube which reminds one forcibly of the exquisite structure made by the marine worm *Arenaria belgica*, which occurs not unfrequently on our sandy seashores. Others will strengthen their tube with very fine grains of sand, making a case in shape like an elephant's tusk. Some will select straight bits of stick or rush, and place them longitudinally, when they will sometimes project far beyond the ends of the caselike handles; others, using the same materials, but in shorter pieces, will place them transversely, putting each piece tangentially to the surface, so that the ends form a perfect *chevaux de frise* round the case, which, if looked at down its length, reminds one of a stocking carrying set after set of the needles with which it has been knitted. But unquestionably the most interesting are those that are adorned with shells. Caddis-worms are excellent conchologists, and by obtaining a number of their cases you may get together a very respectable collection of fresh-water shells. Sometimes you get the same shell throughout, when the case is often extremely elegant and symmetrical; but frequently you may find five or six species on one case, and then, if the shells are very dissimilar, of course the symmetry of the structure is destroyed. The most elegant are those formed of the smaller species of *Planorbis*, flat, spirally-coiled shells, something like tiny snakes rolled up. Of these elegant little objects sometimes as many as fifty specimens go to adorn a single caddis case. Then there are the smaller kinds of *Limnæa*, conical, spirally-twisted shells of delicate texture, one or two of which may sometimes be found filling up odd corners, while, projecting here and there, like so many excrescences, may perhaps be seen the stouter and broader shells of *Bythinus*, the mouth of which is closed by a sort of trap-door. Again, we may find the much smaller and more depressed spiral shells of *Valvata*, which, with the spires all turned inwards, sometimes compose almost the whole case, and, lastly, stuck in here and there wherever there is room, the simply conical abodes of the tiny fresh-water limpets belonging to the genus *Ancylus*. But, besides all these, there are the shells made up of two similar parts hinged together—bivalves, as they are called—belonging to the genera *Sphærium* and *Pisidium*; sometimes a single valve is used, but more frequently the pair, especially of the very common species called *Sphærium corneum*. This is a tolerably bulky shell, and often exceeds in diameter the case which it adorns, so that if three or four of them are used on one case, it acquires a very irregular form. It is not always dead shells that are chosen; very frequently living molluscs are made use of just as they are, though their consent to the arrangement does not appear to be sought, and the plans of their life must be greatly interfered with by this unceremonious attachment. Mr. McLachlan, the historian of the European Trichoptera, says that he has seen the wing-cases of water beetles sometimes mixed with other things as ornaments to the cases, and even the cases of other and smaller caddis-worms, and that, too, while they still contained their inhabitants. The means of attachment of all these objects is the same silky secretion that lines the tube.

The operations of the insect in the construction of its domicile are very interesting, and may be watched by any one who will take the trouble to eject one from its dwelling and provide it with materials for the formation of another. The two following instances are from the records of the continental observers, Meyer and Pictet. The first refers to the formation of a vegetable case. A larva, deprived of its case, seized a piece of reed, and bit off from it a portion of the requisite length; then, cutting a slit in one side, it crawled in and closed up the rent with silk and vegetable débris, and there was the case, fully made. When pieces of reed too short for the case were intentionally given to it, it pieced them out to the required length by cutting off fragments of leaves and attaching them to one end. The other refers to the formation of a mineral case. The larva collected two or three smooth stones of moderate size, and made a low arch by fastening them together with silken threads; then placing itself under this arch, it took up one stone after another, and, with its feet, fitted them in as carefully as a bricklayer would lay his bricks, attaching them to the neighbouring stones when satisfied as to their position. The stones were always placed smooth side inwards. In this way it took between five and six hours to complete the case.

If the case should be made too long, pieces are cut off till the right length is obtained. As not only the length, but also the width of the case, is always suited to the size of the animal, it becomes interesting to inquire how the provision is made for growth in diameter; as the creature grows, each new circle added at the anterior extremity is made of rather larger diameter, thus giving the whole tube a somewhat conical shape; then the smaller end is cut off, and so by repeated additions to one end and subtractions from the other, the case is always the right size, and thus one can understand how it is that a caddis which begins life with a leafy case may, perhaps, end it with a stony or shelly one, and that too without ever quitting its tenement. Some species do not seem to be at all particular as to the materials they use, but others are so fastidious that they will rather go unclothed (which, of course, means speedy death) than adopt the wrong material.

The cases hitherto referred to are free, and the larva drags its abode about with it as it crawls slowly along with just so much of its body projecting from the case as carries the three pairs of legs. But many, especially of the smaller species, and those that live in very rapidly-running water, make cases which are attracted to stones, and consist of oval, irregular masses of fragments of stones. Some, again, live in company under a common covering of vegetable *débris* fastened together with silken threads, while others form on the surface of large stones silken canals covered with slime and mud. These latter are supposed to be, to a great extent, carnivorous, feeding on other aquatic larvæ; but the larger kinds are, as a rule, vegetable feeders, eating the leaves of various water plants, which, when adult, they devour entirely, beginning at the edge, but when young they satisfy themselves with the tender green parts between the veins of the leaf, which are more suited to their juvenile capacities than the tougher veins themselves. They will, however, take to animal food when necessary, and will even, on occasion, turn cannibals.

(To be continued.)

Mr. Bird, the chess-player, has in the press a tract in which he propounds and analyzes an early variation of the commonest opening, which has for some years been associated with his name. The publisher will be Mr. Wade, of Tavistock-street.—*Athenæum.*

NOTES ON COAL.

By RICHARD A. PROCTOR.

(*Continued from p.* 217.)

WE see, then, that coal-seams are the remains of ancient vegetable layers, formed underneath the trees of the ancient forest. But it is not to be supposed that every forest in those old times spread its shade over a mass of decaying vegetable matter, until the time should come when the mass should be covered over with shale or sandstone. In order that coal-seams should be formed, it was necessary that the forest region should be so abundantly watered as to form a forest swamp, like the cypress-swamps of the Mississippi. Yet again, it was necessary that during the fresh-water inundations which helped to accumulate the vegetable matter round the roots of the ancient forest-trees, no mud should be carried into the swamps. As Lyell says, "One generation after another of tall trees grew with their roots in mud, and their leaves and prostrate trunks formed layers of vegetable matter, which was afterwards covered with mud, since turned to shale. Yet the coal itself, or altered vegetable matter, remained all the while unsoiled by earthy particles." This is a fact which seems at a first view altogether perplexing; but, as nearly always happens with the more perplexing features of any natural enigma, geologists have been led by this difficulty to the interpretation of the enigma. It is to this very fact that we owe the most trustworthy information yet obtained respecting the process by which coal-beds were originally formed. The solution is due to the same eminent geologist from whom I have already quoted the statement of the difficulty. "The enigma," he says, "however perplexing at first sight, may, I think, be solved by attending to what is now taking place in deltas. The dense growth of reeds and herbage which encompasses the margins of forest-covered swamps in the valley and delta of the Mississippi, is such that the fluviatile waters, in passing through them, are filtered and made to clear themselves entirely before they reach the areas in which vegetable matter may accumulate for centuries, forming coal if the climate be favourable. There is no possibility of the least intermixture of earthy matter in such cases. Thus, in the large submerged tract called the "Sunk Country," near New Madrid, forming part of the western side of the valley of the Mississippi, erect trees have been standing ever since the year 1811–1812, killed by the great earthquake of that date; lacustrine and swamp plants have been growing there in the shallows, and several rivers have annually inundated the whole space, and yet have been unable to carry any sediment within the outer boundaries of the morass, so dense is the marginal belt of reeds and brushwood. It may be affirmed that generally in the "cypress-swamps" of the Mississippi no sediment mingles with the vegetable matter accumulated there from the decay of trees and semi-aquatic plants. As a singular proof of this fact, I may mention that whenever any part of a swamp in Louisiana is dried up, during an unusually hot season, and the wood is set on fire, pits are burned into the ground many feet deep, or as far down as the fire can descend without meeting with water; and it is then found that scarcely any residuum or earthy matter is left. At the bottom of all these "cypress-swamps" a bed of clay is found, with roots of the tall cypress, just as the under-clays of the coal are filled with *stigmaria*—the roots of the ancient forest-trees called *sigillaria*.*

It will be seen that the circumstances here considered dispose of the theory—once a favourite one with many geologists—that the coal-seams were formed of vegetable matter (the rubbish of decayed forests) which had been carried by rivers into estuaries, and there formed into vast natural rafts. It was supposed that such rafts, sinking to the bottom, became after awhile covered with a layer of sand or mud. The uprightness of the tree-stumps, however, as compared with the position of the coal-beds—that is to say, their position square to these beds—should of itself have disposed of the theory referred to.

Yet, on the other hand, there is great difficulty in understanding under what circumstances the alternate rising and sinking of the level of these delta-swamps, or morasses, took place during the enormously long period of time which must have been occupied in the formation of the carboniferous groups with a thickness amounting in some places to nearly four miles. We see, for instance, that in the case of the Nova Scotia coal-fields there must have been eighty-one distinct submergencies. Now there is nothing remarkable in the mere circumstance that the same part of the earth should have been above and beneath the sea-level through many successive alternations. Geology has long taught that in nearly every part of the earth this must have happened; but that throughout so many as eighty-one such changes those conditions should have been repeated which are necessary for the formation of coal-beds is indeed a most remarkable circumstance. We have, on the one hand, the indications of a surprising degree of subterranean activity, for whether the land sank or the sea rose, there must have been a great oscillation of the earth's crust. But, on the other hand, we see that the great swamps must have retained their horizontal position unaltered for long periods of time. The growth of a forest is not the work of a few years, nor could the accumulations of vegetable matter have been formed quickly. As Lyell says, we have "evidence of the former existence at more than eighty different levels"—overlying levels, be it noticed—"of forests of trees, some of them of vast extent, and which lasted for ages, giving rise to a great accumulation of vegetable matter." Under what condition must the earth's crust have been when such processes were possible? To this question, as yet, geology has given no satisfactory answer. There are considerations, however, which seem at least suggestive of a solution of some of the difficulties here presented.

(*To be continued.*)

MR. MACKAY, of the Royal School of Mines, is announced to give introductory (free) popular scientific lectures at the Highbury Institute, on Sept. 25 and 30. Mr. G. Hawker, too, commenced a series on the "Harmony of Form, as Applied to the Decorative Arts," at the City of London College, on Tuesday evenings. Particulars in the College prospectus.

* It is not quite certain to what type of vegetation these trees belonged. They were formerly supposed to be tree-ferns, but some are found to have had long straight leaves, unlike those of ferns. The reader will probably remember that, after describing the *sigillaria*, the author of "Vestiges of Creation" describes the *stigmaria* as a distinct plant. "Among the most remarkable of the leading plants of the coal era, without representatives on the present surface, are the *sigillaria*, of which large stems are very abundant, showing that the interior has been soft, and the exterior fluted, with separate leaves inserted in vertical rows along the flutings; and the *stigmaria*, a plant apparently calculated to flourish in marshes or pools, having a short, thick, fleshy stem, with a dome-shaped top, from which spring branches of from twenty to thirty feet long." These branches were, in reality, the roots of the *sigillaria*. The mistake is a very natural one, since the coal-seam actually separates the trunk of the tree from its roots. Some, however, have since been found attached to the base of the tree-stumps.

OTHER WORLDS THAN OURS.

A WEEK'S CONVERSATION ON THE PLURALITY OF WORLDS.

By Mons. de Fontenelle.

WITH NOTES BY RICHARD A. PROCTOR.

(*Continued from p.* 221.)

"FOR my part," said I, "I do not believe there are men in the moon: for do but observe how much the face of Nature is changed between this and China; other visages, shapes, manners, nay, almost other principles of reason; and therefore between us and the moon, the alteration must be much more considerable. In the lands that have been lately discovered, we can scarce call the inhabitants men; they are rather animals of human shape, and that too sometimes very imperfect, almost without human reason: he therefore who will travel to the moon, must not expect to find men there."

"What sort of people are they then," said she.

"Troth, madam," said I, "I know not; for put the case that we ourselves inhabited the moon, and were not men, but rational creatures, could we imagine, do you think, such fantastical people upon the earth as mankind is? Is it possible we should have an idea of so strange a composition, a creature of such foolish passions, and such wise reflections; allotted so small a span of life, and yet pursuing views of such extent; so learned in trifles, and so stupidly ignorant in matters of the greatest importance; so much concerned for liberty, and yet such great inclinations to servitude; so desirous of happiness, and yet so very incapable of attaining it? The people in the moon must be wise indeed to suppose all this of us. But do we not see ourselves continually, and cannot so much as guess how we were made? So that we are forc'd to say the gods, when they created us, were drunk with nectar, and when they were sober again, could not chuse but laugh at their own handy-work."

"Well, well," said the Marchioness, "we are safe enough then, they in the moon know nothing of us; but I could wish we were a little better acquainted with them; for it troubles me that we should see the moon above us, and yet not know what is done there."

"Why," said I, "are you not as much concerned for that part of the earth which is not yet discovered? What creatures inhabit it, and what they do there? for we and they are carried in the same vessel: they possess the prow, and we the poop, and yet there is no manner of communication between us; they do not know at one end of the ship who lives, or what is done at the other; and you would know what passes in the moon, which is another great vessel sailing in the heavens, at a vast distance from us."

"Oh," said she, "as for the earth, I reckon it all as good as discovered, and can guess at the people, tho' I never heard a word of 'em; for certainly they all resemble us very much, and we may know 'em better whenever we will, let them stay where they are, 'tis only going to see 'em; but we cannot get into the moon if we would; so that I despair of knowing what they do there."

"You would laugh at me," said I, "if I should answer you seriously; perhaps I may deserve it; and yet, I fancy, I can say a great deal to justify a ridiculous thought that is just now come into my head; nay, to use the fool's best argument, I'll lay a wager I make you own (in spite of reason) that one of these days there may be a communication between the earth and the moon, and who knows what great advantages we may procure by it? Do but consider America, before it was discovered by Columbus how profoundly ignorant were those people? they knew nothing at all of arts and sciences; they went naked, had no other arms but a bow and arrows, and did not conceive they might be carried by animals; they looked upon the sea as a wide space, not for the use of man, but thought it was joined to the heavens, and that beyond it was nothing. 'Tis true, after having spent whole years in making hollow the trunks of great trees with sharp stones, they put themselves to sea in these trunks, and floated from land to land, as the wind and waves drove them. But how often was their trough overset, and they forced to recover it again by swimming? So that (except when they were on the land) it might be said they were continually swimming; and yet had any one but told 'em of another kind of navigation, incomparably more perfect and useful than their own, that they might easily pass over that infinite space of water, that they might stop in the middle of the waves, and, in some sense, command the winds and make their vessel go fast or slow, as they pleased —in short, that this unpassable ocean should be no obstacle to their conversing with another different people, do you think they would have believed you? And yet at last that day has come, the unheard-of and most surprising sight appears, vast great bodies, with white wings, are seen to fly upon the sea, to vomit fire from all parts, and to cast on their shores an unknown people, all scaled with iron, who dispose and govern monsters as they please, carry thunder in their hands, and destroy whoever resists them. From whence came they? Who brought them over the sea? Who gave to them the disposal of the fire of heaven? Are they gods? Are they the offspring of the sun? for certainly they are not men. Do but consider, madam, the surprise of the Americans; there can be nothing greater, and, after this, shall any one say there shall never be a communication between the moon and the earth? Did the Americans believe there would ever be any between them and Europe, 'till they saw it? 'Tis true, you must pass this great space of air and heaven, which is between the earth and the moon; but did not those vast seas seem at first as impassable to the Americans?"

"You rave, I think," said she.

"Who denies it, madam?" says I.

"Nay, but I will prove it," says she; "I do not care for your bare owning it. Did you not own the Americans were so ignorant that they had not the least conception of crossing the sea? but we, who know a great deal more than they, can imagine and fancy the going through the air, tho' we are assured it is not to be done."

"There is somewhat more in it than fancy," I replied, "when it has been already practis'd; for several have found the secret of fastening wings, which bear them up in the air, to move them as they please, and to fly over rivers, and from steeple to steeple. I cannot say, indeed, they have yet made an eagle's flight, or that it does not cost now and then a leg or an arm to one of these new birds; but this may serve to represent the first planks that were launch'd on the water, and which were the very beginning of navigation. There were no vessels then thought of to sail round the world in; and yet you see what great ships are grown by little and little from those first planks. The art of flying is but newly invented; it will improve by degrees, and in time grow perfect, then we may fly as far as the moon. We do not yet pretend to have discover'd all things, or that what we have discover'd can receive no addition; and therefore, pray let us agree there are yet many things to be done in the ages to come."

"Were you to live a thousand years," said the Marchioness, "I can never believe you will fly, but you must endanger you neck."

"I will not," replied I, "be so unmannerly as to contradict a fair lady; but tho' we cannot learn the art here, I hope you will allow they may fly better in the moon: 'tis no great matter whether we go to them, or they come to us; we shall then be like the Americans who knew nothing of navigation, and yet there were very good ships at t'other end of the world."

"Were it so," said she, "the people in the moon would have been here before now."

"All in good time," said I; "the Europeans were not in America, 'till at the end of some thousand of years; so long were they in improving navigation to the point of crossing the ocean. The people in the moon have already made some short voyages in the air; they are exercising continually, and by degrees will be more expert; and when we see 'em, God knows how we shall be surpriz'd."

"It is unsufferable," said she, "you should banter me at this rate, and justify your ridiculous fancy by such false reasoning."

"I am going to demonstrate," said I, "that you reproach me very unjustly. Consider, madam, that the world is unfolded by degrees; for the antients were very positive that the torrid and frigid zones were not inhabitable by reason of their excessive heat and cold, and in the time of the Romans the general map of the world was but very little extended beyond that of their own Empire, which, tho' in one sense expressed much grandeur, in another sense was a sign of as great ignorance. However, there were men found both in very hot and in very cold countries, so that you see the world is already increased. After that, it was thought that the ocean covered the whole earth, except what was then discovered. There was no talk then of the antipodes, not so much as a thought of 'em; for who could fancy their heels at top and their heads at bottom? And yet, after all their fine reasoning, the antipodes were discovered. Here 's now another half of the world starts up, and a new reformation of the map. Methinks this, madam, should restrain us, and teach us not to be so positive in our opinions. The world will unfold itself more to us hereafter; then we shall know the people in the moon as well as we do now the antipodes. but all things must be done in order. The whole earth must be first discovered, and till we are perfectly acquainted with our own habitation, we shall never know that of our neighbours."

"Without fooling," said the Marchioness, looking earnestly upon me, "you are so very profound in this point that I begin to think you are in earnest, and believe what you say."

"Not so, neither," said I, "but I would show you how easy it is to maintain a chimerical notion, that may perplex a man of understanding, but never convince him. There is not any argument so persuasive as truth, which has no need to exert all its proofs, but enters naturally into our understanding; and when once we have learned it we do nothing but think of it."

"I thank you, then," said she, "for imposing on me no longer, for I confess your false reasoning disturbed me; but now I shall sleep very quietly, if you think fit to go home."

(*To be continued.*)

The Amsterdam Exhibition. — Messrs. Ransomes, Sims, & Jefferies, have been remarkably successful in this exhibition, having won the first prize, a prize of honour, value £40, for the best steam thrashing machine; four first prize gold medals and two silver medals for ploughs, and the gold medal for the best haymaker, and the gold medal for the best horse-rake. They have thus achieved the highest honours at the above exhibition.

DICKENS'S STORY LEFT HALF TOLD.

A QUASI SCIENTIFIC INQUIRY INTO

THE MYSTERY OF EDWIN DROOD.

By Thomas Foster.

(*Continued from page* 236.)

NEXT let us notice again the singular delay in the appearance of Mr. Grewgious on the scene. At the latest he would hear of the supposed murder on Christmas Day about noon. He would be deeply moved on Drood's account. The disappearance of the light-hearted but withal generous boy whom he had so easily persuaded to be thoughtful and considerate, would have horrified such a man as we know Grewgious was. But the horror would have been intensified, and accompanied by deep sorrow and earnest sympathy for the fair young girl whom he loved both for her own sake and for her mother's. Recollecting that already once in her young life she had had a terrible and sudden loss, he would have felt how fearful a trial and how great a sorrow the death of young Drood would be to her, and how much more overwhelming even than his death the mysterious disappearance which seemed to tell of some terrible tragedy. We can understand that Grewgious would at first be scarcely able to leave the poor girl,—if he knew no more than the rest of Cloisterham about the disappearance of Edwin. All that Christmas Day he might have stayed with her, though even that would have seemed strange when it was so clearly his duty to make inquiries, and therefore to appear upon the scene where Jasper was so active. That he should have stayed all the 26th and the greater part of the 27th, neglecting for nearly three days so manifest a duty—he who was duty personified—is out of all likelihood, nay utterly impossible.

Jasper, of course, would not be apt to notice this. He was away most of the time. He thought nothing of Grewgious, or if he thought of him at all regarded him with something of the contempt felt by Jonas Chuzzlewit for the man who eventually brought him to justice. (There are in fact some marked points of resemblance between Nadgett and Grewgious.) When Grewgious *did* meet Jasper, his first thought would have been to inquire what news there might be about the disappearance. But he comes to tell Jasper about Drood's separation from Rosa. So little is he an adept at deception that he does not express the horror he would naturally have felt, had he only heard of Drood's disappearance, but simply says, "This is strange news." It is Jasper who, being ever on the watch to seem the thing he is not, says, "Strange and *fearful* news," to which Mr. Grewgious answers nothing, but stood smoothing his head and looking at the fire. He is not at all anxious to hear news from Jasper. After a time, the latter asks, "How is your ward?" surely a question to move Grewgious deeply. But he simply answers, "Poor little thing; You can imagine her condition,"—an evasive reply utterly unlike Grewgious's natural manner. Again it is Jasper who resumes the conversation. "Have you seen his sister?" "Whose?" asks Grewgious, with a curtness, and a cool slow manner, as he moves his eyes from the fire to his companion's face, which "might at any other time have been exasperating." Jasper answers, "The suspected young man's." Grewgious asks, "Do you suspect him?" "I don't know what to think. I cannot make up my mind." "Nor I," says Mr. Grewgious.

Now, supposing Mr. Grewgious to know no more than he is supposed to know, but that Rosa had communicated to him her suspicions of Jasper,—and (what is more) had persuaded him that those suspicions were well founded—

this tone with Jasper could be understood, at least in a man less upright and just than Grewgious. But we know (for we are told as much afterwards) that Rosa is half ashamed of these suspicions and has communicated them to no one. Grewgious has less reason than any one in Cloisterham to suspect Jasper on his own account. It is *absolutely impossible* that he can have any information justifying his cruel tone with Jasper, except from Drood himself, in such a way as I have suggested. Had Drood been really murdered, and in some other way—as through Durdles or Deputy—Grewgious had discovered as much, he would have engaged at once in searching out for evidence, and would have had Jasper kept at least as closely under survey as Neville Landless already was.

Absolutely nothing but certain knowledge that Jasper is a murderous villain, combined with knowledge equally certain that Jasper is not a murderer in fact, can explain the conduct of Grewgious in this interview, or indeed to the end. How this happened to escape the notice of so many who have read the story I do not know; but there can be no doubt on the subject. Nor have I yet met any one of average keenness of intellect who has not at once admitted, when the significance of Mr. Grewgious's conduct has been pointed out to him, that it can be interpreted in no other way. He knows Jasper to have been a murderer in intent; but he knows Drood to be alive in reality: and assuredly he can have learned either fact from no one but from Drood himself.

That, knowing so much, Mr. Grewgious would suffer poor little Rosa to imagine Drood slain, and on her account, a sorrow which must have killed her outright (no one seems to have noticed this, either) is simply incredible. Undoubtedly she knows Drood to be alive; but as certainly Grewgious has not told her who has assaulted Drood. She learns from Grewgious, before Cloisterham knows anything about it, that Drood has been the victim of a terrible and slaughterous attack, but has been saved as by a miracle; and she has had it earnestly impressed upon her that she is not to show by word or deed that she knows of Drood's safety. Later she is to wear mourning for him, as dead. But Mr. Grewgious keeps carefully from her the knowledge that the man who loves her so hatefully is the man who would have slain her once affianced lover, still loved as a dear brother.

What then does Grewgious mean when he says that he cannot make up his mind about Neville Landless? The answer is obvious. He can of course say nothing to Jasper implying that he is sure Landless is innocent. But he can truthfully say he has not made up his mind about him. For he has not yet decided whether to take Landless into his confidence or not. He knows that to one of Neville's impatient temper the scheme of vengeance planned between himself and Drood would be difficult to work. But on the other hand he feels that the suspicions under which Neville must labour will be very hard to bear, though lasting perhaps but a short time. He cannot well take Cris Sparkle into his confidence on this point. Eventually it would seem that he decides to let Neville remain for awhile under a cloud, but carefully watched lest harm should befall him. We know that he eventually arranges that Neville Landless shall have rooms close by his own, where probably Buzzard keeps watch (relieved occasionally, as we find, by Mr. Grewgious himself) over the doings of Jasper in this particular direction.

(*To be continued.*)

Erratum.—In col. 2, p. 247, for "Olbin theory," read "Olber's theory."

POST-MORTEM ATTITUDES.

Dr. BROWN-SÉQUARD has recently published an interesting paper* upon the post-mortem preservation of the attitude that the subject presented at the very moment life ceased. In giving these facts, the principal object of the author was to seek the cause of the phenomenon; but he arrived at the conclusion that a solution of the question cannot be reached in the present state of science.

If this delicate problem embarrasses the learned physiologist, I certainly have not the pretension to offer in this place a satisfactory solution. My only object is to point out a few facts of a special nature that Dr. Brown-Séquard did not allude to. As these are capable of throwing light upon certain points of the question, and of thus helping its solution, I have thought it worth while to make them known.

In order that this phenomenon of the preservation of the last attitude may manifest itself, a few peculiar conditions are necessary, the principal of which appears to be a violent, instantaneous, or quick death. But such a condition very often occurs without a preservation of the attitude being observed; and, on another hand, cases are likewise cited where death seems not to have been instantaneous, nor even very quick (relatively at least), such as the case of a wound in the thigh. There has also been invoked, as an active cause, the moral influence exerted upon the subject in cases where death was not instantaneous, or at least in those in which the subject has had a knowledge or quick perception of the danger that menaced him. Without any explanation of the immediate cause—the starting-point of this instantaneous action of the nervous system—the thing itself has been designated as *sideration*. Now, in pointing out the causes of death that have given rise to a preservation of the attitude, Dr. Brown-Séquard has omitted to mention the cases in which this expression of *sideration* can be applied in all its fulness, properly and not figuratively, and that is in those cases in which death has been caused by lightning.

Such cases are quite numerous, and some details have been ascertained that may throw a light upon the question. I shall, in the first place, cite the most remarkable observations.

1. One of the oldest facts is related by J. B. Cardan, who published a work upon lightning at Lyons, in 1633. Eight farm hands had taken refuge under an oak, in order to protect themselves from a storm, and to eat their lunch. A peal of thunder was heard, and the eight persons, struck dead by lightning, remained in the position that they were occupying. One of them was holding a glass, and another was putting some bread into his mouth, without any modification of the facial expression having occurred.

2. The preceding fact left some doubts, and there has been a disposition to believe it an exaggeration, but another and identical one was afterward reported by a Protestant pastor, Butler, who was a witness of it. On July 27, 1691, at Everdon, ten harvestmen took refuge under a hedge upon the approach of a storm. Soon afterward a thunderbolt fell and killed four of them, who remained immovable, and as if petrified, in the very attitude that they had at the time. One was holding between his fingers the pinch of snuff that he was about taking. Another was holding on his knees a dead dog which he was caressing with one hand and offering a piece of bread to with the other. A third was sitting with his eyes wide open and his head turned in the direction of the storm.

3. Abbé Richard relates that the proctor of the Seminary of Troyes was returning upon horseback, when he was struck by lightning. A brother, who was following him, not having perceived it, thought he was asleep because he saw him tottering. Upon trying to awaken him he was found to be dead.

4. Another and analogous case is likewise related in the funereal annals of lightning. A priest was struck while upon horseback, without the animal being injured. The latter continued his accustomed route, and reached home with the dead horseman, who still preserved his attitude. The distance thus traversed was about two leagues.

5. On May 9, 1781, at about three o'clock, the lightning struck the door of the chapel of the Commandery of St. John, near which a woman and three children had taken refuge. The woman, who was seated in front, was suffocated without changing attitude, as was also one of the children.

6. On August 14, 1793, a man, surprised by a storm in the environs of Dover, took refuge with four horses in a thicket. A thunderbolt having fallen, the four horses and the man were killed, with the peculiarity that the latter remained seated.

7. On Sunday, July 11, 1819, the Church of Chateauneuf (Lower Alps) was struck by lightning during divine service. A large number of persons was struck (82 wounded and 9 killed). The peculiarity to be pointed out is, that all the dogs that were in the church were found dead in the attitudes that they previously had.

8. At Vic-sur-Aisne in 1838, three soldiers, in the midst of a violent storm, took shelter under a linden, when, by the same stroke of lightning, all were instantaneously killed. Moreover, all three remained standing in their original position, just as if the electric fluid had not touched them. Their clothing was intact. After the storm, some passers by who saw them, having spoken to them without getting any answer, approached and touched them, when they all fell into a heap of ashes.

9. In the month of July, 1845, four inhabitants of Heiltz-le-Maurupt, near Vitry-le-François, took refuge, three of them under a poplar and one of them under a willow. Soon afterward, the one who was under the willow, and leaning against it, was struck by lightning. A bright flame was issuing from his clothing, but he did not appear to see it. "You are burning! Don't you see that you are burning?" cried his companions (see engraving). Upon running to him they found he was a corpse.

10. An animal forms the subject of this observation, which was made after a winter storm, in January, near Clermont. A goat was struck by lightning and immediately killed. It was found standing upon its hind legs still holding a green branch in its mouth.

11. A young woman, the wife of a miner of Ricamarie, had gone to visit her family at Saint Romain-les-Atheux, taking with her her four-months-old child. It was on July 16, 1866, and she was alone in the house during a storm. When her parents returned from the field, a sad spectacle awaited them, for the young woman had been killed by lightning. She was found on her knees in a corner of the room, with her face concealed in her hands. She bore no trace of a wound. The child, which was lying on the bed in the room, had been but slightly touched by the electric fluid.

12. I have related the preceding observations in chronological order, but I terminate with one, nevertheless, that should have come first. It is narrated by Quintus Curtius (lib. viii., cap. iv.). Alexander the Great was traversing Asia, and spreading ruin on his way. When he reached the region now called Bokhara, his army was assailed by a frightful cyclone. This terrible tempest carried off nearly a thousand men—soldiers, sutlers, or valets. It is said that some of these were found leaning against the trunks

of trees, and seeming to be still alive and talking with each other, in the same situation in which death had overtaken them.

The observations which precede seem to us to furnish some useful information in regard to some points of the question. Thus, a perception of danger is not necessary to explain the influence exerted upon the subject. The case of the soldier observed at Beaumont, near Sedan, seems to be demonstrative. He was not conscious of danger, by reason of the quick and unforeseen action of the bullet. This cause most certainly cannot be invoked in case of death through lightning. It is perfectly demonstrated by numerous observations that the subjects thus struck have not and cannot have any apprehension of their imminent danger. The person who is struck by lightning not only does not hear the noise of the thunder, the propagation of which is relatively slow, but he has not even any perception, any warning of the flash, whose rapidity is proverbial. Death is instantaneous, and the subject has not experienced the moral influence that results from a perception of danger. We have particularly related the cases that comprise animals (obs. 7 and 10). These could not have had any such apprehensions. It is remarkable to see that *all* the dogs were struck, and that all preserved their attitude in the occurrence at Chateauneuf, while the number of human victims was proportionately much less. None of these latter, moreover, preserved the attitude that he had at the moment of death. In obs. 6 a man preserves his position and remains seated near four dead horses that did not maintain *their* attitude. In obs. 1 we see that *all* the individuals exposed to the action were killed, and *all* (to the number of eight) preserved their attitude. In the second case four out of ten were struck, and the six others do not appear to have been influenced by the electric fluid. In short, all those that were struck dead preserved the last attitude of life.

Cases of lightning stroke are unfortunately quite numerous, but the number of those in which a preservation of the attitude has been observed is relatively limited. Although there are no comparative figures upon which an exact proportion can be established with certainty, it nevertheless appears that they are more frequent after lightning stroke than after other modes of sudden death.

Let us further remark that in cases of death by lightning, with a preservation of the attitude, it has been found that no external lesion exists (obs. 11) upon the body of the victim, and no autopsy has shown what point was thus influenced without any apparent contact. Perhaps no peculiar alteration could have been found in the essential organs of life; and it is especially in such cases that we may employ the expression *sideration* in all its acceptations.

The peculiar circumstances that accompany death by lightning may acquire (as they have done) a certain importance from a medico-legal point of view. But I have not to concern myself with that here, my only object having been to point out a few interesting facts, whence we may draw some useful data for the study and solution of this question of post-mortem preservation of the last attitude of life.—Dr. J. Rouyer, in *La Nature*.

An illustration of the way in which a coefficient like 0·000006, the coefficient of expansion of steel, may become a big thing with a few degrees and long lengths, has been seen on the new Midland line between Irchester and Sharnbrook, recently opened for goods traffic. The rails were laid during winter time, and insufficient room was left for expansion; consequently the summer heat lately expanded the rails to such an extent that the road burst out of line. Traffic had to be at once stopped, and the permanent way altered and properly spaced.

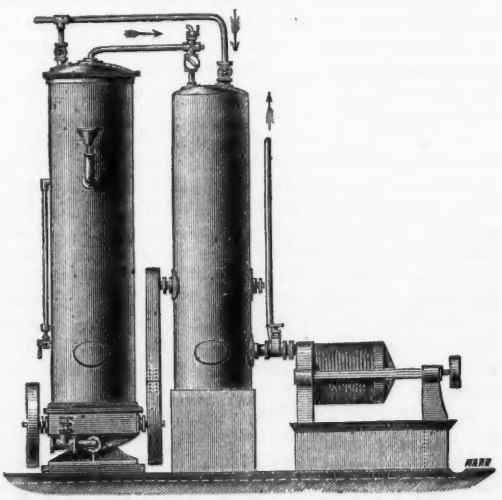
THE INTERNATIONAL HEALTH EXHIBITION.

XVII.—THE SOFTENING OF WATER—(*continued*).

In our last communication we pointed out that although very soft water is in many instances undesirable, it is of the first importance to the vast majority of manufacturers and engineers. The uses to which softened water can be put are so varied and extensive that the subject has claimed and received the attention of many competent and active workers. We have shown that in order to be of practical value, softened water ought to be freed from all mechanical as well as dissolved impurities, and that these results are to be attained not only by a successful system of straining, but by chemical means in addition.

In 1781, a paper was read to the Literary and Philosophical Society of Manchester by Thomas Henry, F.R.S., in which he gave an account of his process for purifying sea-water by the use of quicklime; he referred also to the value of that reagent in the preservation of common water. It was not until 1838, however, that a patent process for the softening of water was instituted. Muriate of zinc, subsequently acted upon by salts of soda, was employed to precipitate the impurities from water.

Later on, in 1841, Dr. Thomas Clark, the Professor of Chemistry at the University of Aberdeen, patented the well-known process with which his name will always be associated. He published a complete description of it in the Journal of the Society of Arts on the 16th May, 1856. Clark's process takes advantage of the solubility and insolubility of lime in the two conditions in which it becomes associated with carbonic acid gas.



The Porter-Clark Apparatus. In operation at the International Health Exhibition (400 gallons per hour).

The vast formations of limestone, chalk, and other calcareous rocks of hard water districts consists of lime in the form of a carbonate. The percolation of water, such as ordinary rain-water charged with carbonic acid gas through calcareous strata, results in the removal of the carbonate by its solution as a bicarbonate, and gives rise to a hard water. To remove that hardness it is obvious that a separation of this extra quantity of carbonic acid would leave the lime once more in the character of an insoluble carbonate, and this is exactly what happens when lime water is used.

Lime is made by burning ordinary limestone or chalk in a kiln; almost all the carbonic acid gas is driven off and lime remains behind. The process of burning cannot always be fully completed, and individual cases are liable to differ slightly from one another, so that only approximately pure lime is produced. Now this lime is soluble in water, but, for the reasons just stated, it will not entirely dissolve; hence, in making the solution, it is advisable to use a slight excess of lime. A solution thus prepared may then be added to the hard water, when the carbonic acid of the dissolved bicarbonate will react on the lime of the lime-water, and leave the original bicarbonate of the hard water in the form of an insoluble carbonate; at the same time the soluble lime of the lime-water takes up the liberated carbonic acid, and becomes also changed into an insoluble carbonate. Thus, two quantities, both of them insoluble, are separated, and sink to the bottom of the vessel as a fine white precipitate of microscopical crystals of carbonate of lime, leaving the water practically soft and fit for ordinary use. The process has the great advantages of being extremely simple, adequately reliable, and comparatively inexpensive. It has been estimated that a bushel of lime, weighing about fifty-six pounds, and valued at 4½d., can make four thousand gallons of very strong and clear lime-water, capable of softening about ten times that quantity of hard water of the nature of the London district supply.

That Clark's process is amply adequate to the supply of a valuable water may be gathered from the following quotation of results, which indicates the reduction in hardness attained by its employment:—

"The Porter-Clark Process," by J. H. Porter, 1884, p. 4.

Canterbury	26·3 to 4·9
Caterham	21·2 „ 4·4
Tring	26·3 „ 3·2

The most serious objection to the process, however, is, that when carried out on an extensive scale, the reservoirs must be large and very costly. The precipitation of the carbonate of lime, too, is, at most, extremely tardy in action, and its accumulation in the tanks a most undesirable item. All these drawbacks have been remedied in the modified system known as the "Porter-Clark Process," which is now being exhibited at South Kensington in Stand 1,231, situated in a special building in the grounds, outside the Western Gallery. An interesting pamphlet* has been written upon the subject by Mr. Porter, in which much valuable information is recorded. It is there shown that the Porter-Clark process provides for the treatment of large quantities of water within a small area; that the supply can be regulated under continuous pressure at any desired rate per hour, and that the filtering machinery used is so constructed as to secure a purification of the filtrate, and a prevention of subsequent contamination, through the layer of precipitated carbonate of lime, which, in its turn, can be easily removed. The chemical reaction, too, is facilitated by the continuous agitation of the water with the re-agent, and we may fairly congratulate the inventor on having successfully overcome the many obstacles to the effectual working of a system of water purification which needs but to be known to be highly appreciated and generally adopted.

We hear that it is proposed to publish by subscription the "Vital Statistics of the late Dr. William Farr" in an octavo volume of some 450 pages. All interested in this very important posthumous work of our famous English statistician should communicate with Mr. E. White Wallis, the Secretary of the Sanitary Institute of Great Britain, 74A, Margaret-street, Regent-street, W.

* "The Softening and Purification of Hard Waters," by John Henderson Porter, A.I.C.E., 1, Tudor-street, London, E.C., 1884.

Editorial Gossip.

In no way can the amateur astronomer do a more immediate public service than by supplying correct time to a district far from a post-office to which it is flashed by telegraph; and possessors of small transit instruments may pick up a profitable "wrinkle" or two in connection with this from the perusal of an article on taking time observations in the current number of that capital little American serial, the *Sidereal Messenger*.

And while mentioning the *Sidereal Messenger*, the number of which I have just spoken also contains an account of a remarkable apparition on the evening of July 30, ult., of a narrow, thin, white cloud, like a comet's tail, which seems to have crossed the sky in a somewhat similar manner to (though not in the same direction as) the strange fusiform magnetic or auroral cloud observed in England by Mr. Rand Capron and others, on Nov. 17, 1882. It was seen at Atlantic City, New Jersey.

Believers in the influence of sun-spots on the weather may note that while we have enjoyed great and exceptional heat here during the present summer, it has been one of the coldest known for many years in Constantinople, where the mean temperature for July and August has actually been three degrees below the average. Presumably they have the same sun in Turkey that we have in England. There have further been some splendid spots and groups of spots on the sun's face during the past few weeks, although the (official) period of maximum has passed.

The strange and beautiful sunsets, or rather "after-glows," still continue. In connection with the persistence of this phenomenon it is noteworthy that on the very clearest days a strange kind of haze still surrounds the sun; in fact, while in the opposite quarter of the heavens the sky is of the most vivid cerulean blue, for many degrees around the sun is a very faint, but semi-opaque, veil, which becomes at once visible on hiding the sun with the hand and regarding the neighbouring region. A valued friend and correspondent of great eminence in the scientific world suggests the question whether this "mutton broth" (as he calls it) is really atmospheric at all, in fact, whether it may not be cosmical and a true appendage of the sun? If so, yet another explanation would seem to be possible of our wondrous evening skies than that afforded by Krakatoa dust.

Many people fondly hoped that the discovery by Dr. Koch that the "comma bacillus" was invariably presen in (and was, in fact, the active agent in the production of) cholera, had brought us in sight of the means of combating that ghastly scourge. Unfortunately, Surgeon-Major Lewis, of the Army Medical School at Netley, who has been investigating this question at Marseilles, has come to the conclusion that the "comma" is neither more nor less injurious than any other microbe; so that we are landed very much where we were before the commencement of Dr. Koch's researches.

Vaccination in the Army and Navy.—A return, showing the efficacy of vaccination, has been issued, entitled "Small-pox (Army and Navy)." In 1882 the annual strength of the army was 174,557, and the number of deaths from small-pox was five, or in the ratio of 0·3 per 1,000. The number of men entering the service that year was 26,129. In the navy a similar excellent result was noticeable. In 1882 the mean strength was 57,067; the number of deaths two, or a proportion of 0·3 per 1,000; and 6,998 men entered in the year. As every man who enters her Majesty's services is compelled to submit to vaccination, these figures, if submitted to persons of ordinary intelligence, and not to rabid anti-vaccinators, would be absolutely convincing.—*Medical Press and Circular.*

XUM

Reviews.

BIBLE FOLK-LORE.*

By Edward Clodd.

BUT a few years ago such a book as this, which will probably fall as a *brutum fulmen*, would have brought down the anathemas alike of Archbishops and local preachers on its author, and have been put on the Index of every Little Bethel library. When Dean Milman published his very harmless "History of the Jews," he withheld his name, and with a sound decanal instinct, for its orthodox readers were shocked when they found Abraham described as an Arab Sheik. Well for such timid souls that they have gone where the wicked Kuenen and Goldziher cannot trouble them, or the author of "Rabbi Jeshua" disturb their abiding calm by his resolution of well nigh every venerated name among patriarch, king, and prophet into solar phenomena.

Books like Dean Stanley's "Jewish Church," Baron Bunsen's "God in History," and Ewald's great but inconclusive work, paved the way for the application of the same scientific criticism to the Hebrew Scriptures which has been applied with such success, in the removal of difficulties, to cognate early histories of other races.

The epoch-making book in this matter is Kuenen's masterly "Religion of Israel," since it marks the nearest approach to the settlement of questions as to the age, sources, and general credibility of the documents which comprise the Old Testament. Following him, came the less sober work, so far as its speculations were concerned, of Dr. Ignaz Goldziher's "Mythology among the Hebrews," which thus, on its outside, challenged M. Renan's now generally discredited dictum that "The Semites never had any mythology."† Goldziher was, however, moderate in his application of the solar theory to the explanation of the historical books of the Bible, as compared with our author, whose cock-sureness (the term is Shakspearean) awakens a feeling of irritation almost fatal to any calm consideration of his book. The effect, as with Cox, Gubernatis, and others of the school, can only be to lessen the force of the inherently sound elements in the theory, and to deepen the resulting scepticism about its validity, when it explains everything so completely that it may mean anything else just as well.

"Bible Folk-lore" is crammed with information, though this is not always well digested. It has throughout evidence of much learning, gathered with no small labour, and the matter is often, as in the opening chapter, where the seasonal changes in Syria are described, presented in a picturesque and vigorous style. But the unsoundness of some of the etymological speculations, as *e.g.*, where the author asserts that, "Osiris is the Sanskrit Asuras, the 'breathing one'"; Isis is Ushas, "the dawn"; Horus, the Indian Hari, "the golden one, son of God" (p. 52), excites distrust in regard to the rest; and the choice of title is unfortunate, for it is only here and there (pp. 131, 143, 183, &c.) that the subordinate subject of folk-lore is dealt with. The book seeks to cover the field embraced by Jewish and early Christian history; to discover what proportion of the mythical, illustrated by similar myths in more ancient writings, has entered into the record of that stretch of time, and the title and sub-title should have changed places.

Although the pages of this Journal are properly closed to the discussion of theological topics, Knowledge would strangely belie its title if it did not, in the recognition that a science of man is possible, set before its readers from time to time some account of the results at which historical critics, dealing with the Old Testament as with any other ancient document, have arrived concerning the sources and character of its contents. The light shed, more especially on its earlier portions, by comparing them with kindred legends in other sacred books; the bringing out of correspondences which point to the common origin of the whole, or to the borrowing of the many from one primitive source; the assignment of the several influences from without which profoundly affected Jewish belief, and reshaped and coloured the narratives which embody it; these are of the utmost value as guides along the tortuous path by which we would track the emergence of the Hebrews and their fellow-Semites from the mythopœic and polytheistic stage.

Apart from the existing ignorance on these matters, one feels that the decay of Bible-reading—for the fact is undoubted—among the intelligent classes nowadays is much to be regretted. There is always a large section of people who read for edification, but with these we are not concerned. It is in the neglect of the Bible as a venerable record of human experience and speculation concerning the unseen; as preserving poetry which yet moves us like a solemn chant; as embalming the beauty and vigour of our English tongue before the hardening influences of classic terms; as a great literary force, that it is to be deplored people do not know their Bibles. One has only to read the masters of felicitous style and happy illustration, like Huxley, Clifford, and Matthew Arnold, to see whence is due the inspiration of sonorous word and stately figure which moves through their writings.

Any abstract of the contents of "Bible Folk-lore" would extend over some pages, and it must suffice to illustrate the author's conclusions by a few examples. As the names of twelve antediluvian patriarchs and the related myths are said to correspond to the natural phenomena of each month, he sees in this group the legend of the year. Cain and Abel are the day and night. Cain, as the sun, producer of corn and wine, is the foe of Abel, the night-vapour, whose fleecy clouds are flocks on the horizon, and when the sun slays him, and his dark-red blood stains the morning sky, the murderer wanders like Indra and other sun-gods, "in eternal vagabondage." In the legend of Jubal we have the music of heaven made by the winds and the thunder, and in that of the Deluge, with which the cycle of legends ends, the author, after comparing it with variants of the Flood-tales, finds that "Noah, in his coffer of evergreen wood, like the Persian Yima in his paradise, represents the hopes of the coming spring, when, the winter floods over, he emerges with the seeds of plant and animal life. Abraham, Isaac, and Jacob, "the sun-heroes of the three seasons," into which the Accadians and other peoples divided the year, are triads corresponding to solar and meteorological deities of India, Assyria, &c., and the names of the celebrated twelve sons of Jacob, from Reuben to the "wintry Joseph" and Benjamin, indicate their astronomical origin. The destruction of the cities of the plains is the eternal battle of the heavens, localised by the sterile aspect of the dreary region round the Dead Sea.

It is quite refreshing, after all this, to learn that "the immigration of the Semitic tribes into Lower Egypt before 2,000 B.C. is a well-known fact," but the author hastens to state his conviction that Moses is a sun-myth. He is found, like the new-born Horus, in his local cradle; he appears as sun-god to give laws from Sinai, and on Nebo sinks to his rest in the west. All the plagues of Egypt

* "Bible Folk-Lore: an Essay in Comparative Mythology." By the author of "Rabbi Jeshua." (London: Kegan Paul, Trench, & Co. 1884.)

† "Les Sémites n'ont jamais eu de mythologie."

have reference to the darkness and the sunset; "the children slain before the infant sun appears are probably the countless stars who are swallowed up by the sun at his rising." Passing to the heroic period, the destruction of Jericho's walls is the moon-city whose cloud-buildings fall in the fair moonlit night. And as the twelve months have their mythical symbols in the patriarchs, and the signs of the Zodiac in Jacob's sons, so the four seasons have theirs in Joshua, Barak, Abimelech, and Jephthah; the story of Samson, in the undoubted solar incidents of which our author is on solid ground, summing up the cycle of the year. And the ground is firm, too, in his discussion of the nature aspects which lie thinly veiled behind the Semitic gods, the ghastly character of the sacrifices to which show the fear of the unknown, unmeasured powers of the universe which possessed the hearts of the warlike sons of the desert. On the *vexata quæstio* of the origin of the Jehovah cult the author has much of interest to say, but he is in error, if the authority of Mr. Page Renouf is to be recognised, in identifying the Nuk-pu-Nuk of the Egyptians as the exact equivalent of "I am that I am." * Even if slaying the slain, he is, however, doing good service in refuting M. Renan's untenable theory of a monotheistic instinct in the Semitic race, for the records of the various members of that family show that their mode of religious development has, speaking broadly, been identical with that of other races. That it has been parallel is not pretended, for allowance has to be made for different conditions inducing different phases; but this is not contradictory, rather is it confirmatory of the general doctrine that the type of religion is largely determined by physical conditions producing subtle variations. Speaking of the influence of the Persian religion on Jewish belief, the author remarks, "Strange indeed is the irony of religious history which has led us to consider the idea of monotheism, so taught to Semitic demon-worshippers, as being a truth specially revealed to a small Semitic tribe, and a great idea distinctive of the Semitic genius" (p. 118). He contends that not until the foundation of the Hebrew kingdom have we left the mythopœic age and entered the traditional, although with this, as with many real persons and events, the mythical still largely blends. How much so, the canon "the marvellous is the measure of the mythical" helps us to determine.

The fundamental changes wrought in Jewish theodicy during the captivity in Babylon, notably in the transformation of Satan, a messenger of deity, into an arch-fiend;† the substitution of Abaddon, a hell of torment, for the old Sheol or Hades where good and bad alike go; the more precise formulating of a doctrine of immortality and of a resurrection; the impetus given to the hope of a Deliverer, and to the general eschatology, are admirably explained.

The allegorical features of the literature of the Greek and Herodian periods, Tobit, Bel and the Dragon, &c., are expounded; Daniel's escape from the den of lions is the old Sun's deliverance from the fierce cloud-animals. The general conclusions at which the author arrives are appositely expressed in this sentence:—"It is not a divinely-inspired record which we have examined, but a mythology of Egyptian and Assyrian origin, a ritual based on the most ancient laws and customs of the Aryans, a poetry whose most noble thoughts and images may be matched, if not excelled, by the hymns of the Vedas and of Egypt, or even by those of Babylon and Chaldea." In his chapter on the Essenes, the author's sympathies, ever expanded, as those of each one of us must be the more we know of the great Gautama the Buddha, are manifest in the account of his gradual apotheosis in the lapse of time when to refracted vision it seemed that in the past "the gods came down in the likeness of men." In pointing parallels for our consideration, the author, however, inspires mistrust in virtue of the untenable canon which is laid down in his appendix. He says, "The doctrine of evolution teaches us that where features are found common to two developments, they are generally due to a direct connection of growth between the two." The doctrine of evolution teaches exactly the contrary. As Bastian remarks, "Where no historical transference can be proved, the uniformity must be referred to the organic law of the growth of the mind, which will everywhere put forth similar products, corresponding and alike, but variously modified by surrounding influences."*

In the world-wide discovery of stone implements of similar design, the question of borrowing between one race and another does not arise, it suffices that the same needs excite the same methods of supply among rude peoples, past and present. And the like applies to the satisfaction of man's immaterial needs. We find that among the Incas, when any nun violated her vow of chastity or allowed the sacred fire to go out, she was buried alive. The same punishment was inflicted for the same offences on the Roman vestal. But no one suggests that the Peruvians borrowed this custom from the Romans; still less the Romans from the Peruvians. The virgin had proved herself false to her spouse the Sun; let her, therefore, become the spouse of Darkness, and let the earth swallow her up.

Into the question of the proportion of mythical element which has become mixed with the early Christian records, we cannot here enter, especially as the author again falls back upon his first principles of interpretation, and summons the hosts of heaven as witnesses, as when in the story of the Transfiguration, illustrated by variants from other scriptures, he sees the triad of the rising, and noonday, and the setting sun.

The weakness of the book lies in its fantastic etymologies (one has only to turn to Goldziher to see how varied are the meanings of the proper names), and in the wholesale application of the solar theory to events which, whilst without doubt charged with the mythical and legendary, have a body of fact corresponding to what we know to be the conditions under which wandering tribes pass to a settled state, and under which they advance from animistic to monotheistic belief.

The strength of the book lies in its insistance on the application of the comparative method to the interesting and priceless records of this progress among the Hebrew members of the Semitic family, and in its witness to the absence of all arbitrariness from the successive evolutions of the human mind as from every other department of nature.

Whatever the reason, be it indolence or false economy, much blame attaches to the issue of a book so crowded with topics as this without an index.

SOME BOOKS ON OUR TABLE.

Natural Law in the Spiritual World. By HENRY DRUMMOND, F.R.S.E., F.G.S. Eleventh Edition. (London: Hodder & Stoughton. 1884.)—Amid the mass of decla-

* It is distinctly on grammatical grounds that I reject the translation in question, which is not a literal but simply an erroneous one. Neither in the Book of the Dead nor in any other known Egyptian text do the words Nuk-pu-Nuk occur as a sentence. I do not believe that it could under any circumstances be translated "I am that I am."—Letter to the *Academy*, June 26, 1880.

† The author, perhaps by a *lapsus calami*, speaks of the Indian devil, Mâra, as King of Death (p. 153). Yama is the ruler of Death; Mâra is the spirit of evil, who tempts the Buddha.

* Cf. Goldziher, xvi.

XUM

mation, abuse, frothy rhetoric, perversion of science, distortion of Scripture, ascription of moral obliquity to opponents, and assumption of infallibility on the part of the disputants, which has recently been rained upon us in the shape of (so-called) "Reconciliations," it is perfectly delightful to turn to the calm, judicial, scholarly, and pre-eminently tolerant work of Professor Drummond, now before us. For surely no more able contribution than this to the polemics of natural theology has been made for a very long time indeed. Starting with the assumption that law reigns as supreme in the spiritual world as it does in the material universe, our author sets himself to show, with impressive ingenuity, how every natural law has its spiritual analogue; and so essays to remove certain stumbling-blocks, and throw light upon more than one obscure problem which religion presents. Mr. Drummond frankly accepts the modern doctrine of evolution in its entirety, quoting freely from Herbert Spencer, Darwin, Huxley, &c., in support of his views. His obviously great personal familiarity with biological science enables him to derive some of his most telling illustrations from the more recondite phenomena of the development of life; and there is something admirable in the ability with which he co-ordinates and shows the absolute parallelism of the laws regulating that development with the fundamental principles of Christianity. His style is charming, his diction essentially that of a scholar and a man of refined taste. Hence his book is an eminently readable one. That it will make numerous converts from the ranks of a mere stupid atheism it would be too much to expect. That, however, it will remove some of the doubts, and strengthen and comfort thousands of religious men, whose faith has been sorely strained by honest philosophical misgivings, it seems impossible to question. Professor Drummond has given us a most remarkable volume.

Lectures on Teaching, by J. G. Fitch, M.A.; *General Aims of the Teacher:* Two lectures by F. W. Farrar, D.D., and R. B. Poole, B.D.; *Three Lectures on the Practice of Education*, by H. W. Eve, M.A., Arthur Sidgwick, M.A., and E. A. Abbott, M.A., D.D. (Cambridge University Press.)—We have classed these three works together as valuable and important contributions to the science, as well as to the mere art, of education. Mr. Fitch's work, in particular, is so exhaustive in its details that no one engaged in practical educational work can afford to neglect its perusal. Even did he speak with less authority than that to which he is justly entitled, the intimate knowledge of his subject which he displays, nay, the mere common sense of his remarks, must commend his lectures to the careful study of all concerned in the welfare and intellectual advancement of the rising generation. Canon Farrar's lecture on "The General Aims of the Teacher" forms really a charming piece of reading for anybody, containing as it does a record of his own personal experiences, conveyed with all that charm of style for which his writings are distinguished; while Mr. Poole's, if not quite equal to it in a literary point of view, is important as conveying the views of one so experienced as its author. The mere names of the authors of the three lectures in the work whose title concludes our heading will suffice to indicate their practical and technical value.

A Sketch of Ancient Philosophy from Thales to Cicero, by J. B. Mayor, M.A. (Cambridge University Press.)—Concise, without being bald, and commendably free from metaphysical jargon, Mr. Mayor's history of philosophy, extending over a period of nearly 600 years, will be welcomed by the student who wishes to gain clear ideas of the progress of human thought from the time of the illustrious Miletian down to that of the mighty Roman orator. That ancient philosophy was not all logomachy, nor the utterances of the sages of the past mere "Sound and fury, signifying nothing," a perusal of Mr. Mayor's work will speedily convince the reader.

The Cambridge Bible for Schools and Colleges. Job, edited by A. B. Davidson, D.D., LL.D.; *St. Luke*, edited by Canon Farrar, D.D. (Cambridge: University Press.)—Judging from the two instalments of the work before us, we have, so far, seen nothing to surpass, even if we have met with anything to equal, this admirable Bible Commentary. Beginning with Dr. Davidson's volume, we may say that while he does not deny the historical existence of Job, he yet regards the book so-called as a sacred drama or poem, composed at the very earliest during the reign of Solomon. The reasons for this are given at length in the admirable introduction. The student who will re-peruse the book of Job in the light of Dr. Davidson's exegesis, cannot fail to derive both instruction and pleasure from it. It seems needless to say more in connection with the volume containing St. Luke's Gospel, than that the sound learning and literary ability for which the Canon of Westminster is renowned are conspicuous in a commentary which must render the most valuable aid to every reader of the New Testament.

The A B C of Modern (Dry Plate) Photography. (London: The London Stereoscopic Company.)—Reading through the most explicit and detailed description of each successive step in the production of a photograph given in the little volume before us, from focussing the camera to drying the finished prints, it would really seem as though nothing short of actual aberration of intellect could prevent any one who will peruse it with common care from becoming a successful photographer. The beginner is told not only what to do, but what *not* to do; the causes of failure are clearly pointed out, and numerous illustrations supplement the text. Verily, this is the A B C of photography.

Tricycling for Ladies. This excellent little book has been written by a *lady* for ladies. Miss Erskine describes the machine and its accessories, the use of the machine, ladies' tricycling dress, the best method of riding, touring, the bye-laws applicable to tricycles, and concludes with some remarks on sketching and photography for lady riders. Under every heading will be found much interesting and useful information which could only be obtained by considerable experience. The book is very neatly written, and beautifully printed, and we can strongly recommend it to any lady about to commence tricycling, or those who are now cycling and wish for hints which will assist them in this most healthful recreation. From the apt quotation on the title-page to the last sentence on photography, every line is to the purpose.

Merry Matches, the popular new round game for children, containing thirty-one original coloured drawings of popular nursery characters (Wyman & Sons, 74–76, Great Queen-street, London, W.C.)—In the packet of cards now before us we have, perhaps, one of the most striking examples of the progress that has arisen from the valuable modern systems of juvenile education. To cultivate the tastes of the young by providing them with an entertaining game in which the whole merry circle can join, and to guide their thoughts into the many happy incidents of their nursery life, to Old Mother Hubbard, Dick Whittington, Cinderella, Father Christmas, &c., by means of beautifully limned and coloured illustrations, is, we think, so praiseworthy an effort and productive of so very much that is to be highly prized in the development of refined tastes in the young, that we feel it our duty, in the interests of all those who are

entrusted with the training of children, to bring this most useful contribution to the wants of the household to their notice, and in so doing we can rest assured that they will have ample reason to congratulate themselves on having added to the comforts of a happy home.

THE FACE OF THE SKY.

FROM SEPTEMBER 26TH TO OCTOBER 10TH.

BY F.R.A.S.

THE Sun, as heretofore, will be examined whenever the sky is clear for spots and faculæ. The Night Sky will be found delineated on Map X. of "The Stars in their Seasons." Minima of Algol will be observable at 11h. 31m. p.m. on September 27, and at 8h. 20m. p.m. on the 30th. Mercury attains his greatest elongation west of the sun (17° 55′) at 3 a.m. on the 5th, and at this time may be well seen in the east before sunrise. Venus is still brilliant and conspicuous as a morning star, but is becoming a less interesting object in the telescope, as she is assuming a gibbous, or humped, figure, like the Moon when between full and her last quarter. Mars continues invisible, and Jupiter does not rise until between 1 and 2 o'clock in the morning. Saturn, however, is above the horizon about a quarter to nine o'clock at night at the beginning of October, and about 10 minutes past 8 when our notes terminate. Uranus is absolutely invisible, and Neptune, in an utterly blank region in Taurus, may be seen after 8 o'clock in the evening in the east, attaining a considerable height above the horizon by midnight. The Moon enters her first quarter at 10h. 21m. a.m. on September 27, and is full at 10 o'clock at night on October 4. Hence the first half of the period of which we are treating will be the best to observe her in. During the next fortnight there will be four occultations of stars by the Moon. On October 1 θ Aquarii, a star of the 4½th magnitude, will disappear at the Moon's dark limb 40 minutes after midnight, at an angle from her vertex of 77°. Afterwards it will reappear at 1h. 7m. a.m. on the 2nd, at the bright limb, at a vertical angle of 29°. On the 3rd BAC 8,311, a 6½th mag. star, will disappear at the dark limb at 8h. 12m. p.m. at an angle of 69° from the vertex of the Moon, to reappear at the bright limb at 9h. 19m. at a vertical angle of 292°. On October 6 a 5th mag. star, 38 Arietis, will disappear at the Moon's bright limb at 9h. 9m. p.m. at a vertical angle of 39°. It will reappear from her dark limb at 10h. 2m. at an angle of 283° from her vertex. Lastly, on the 9th, 130 Tauri, a 6th mag. star, will disappear at the Moon's bright limb at an angle from her vertex of 73° at 9h. 45m. p.m., its reappearance at her dark limb happening at 10h. 37m. p.m. at a vertical angle of 219°. The Moon is in Ophiuchus at noon to-day, but quits that constellation for Sagittarius at 1 o'clock to-night. Her passage across Sagittarius occupies until 11 a.m. on the 29th, when she enters Capricornus, and, crossing that constellation, crosses its boundary into Aquarius at 3 a.m. on the 30th. She does not quit Aquarius until 2 a.m. on October 3, at which hour she passes into Pisces. It is midnight on the 5th ere she has traversed this great constellation and entered Aries. At 3 o'clock in the afternoon of the 7th she quits Aries for Taurus. Travelling through Taurus, she arrives half an hour after midnight on the 9th on the western edge of the extreme northerly strip of Orion, and, as she crosses this in 12 hours, it is evidently noon on October 10 when she emerges in Gemini. She is passing over Gemini when our notes terminate.

DURING the past few weeks over a ton of mushrooms has been despatched every day from Dublin to Liverpool.

SIR R. TEMPLE, in his presidential address to the Economic Science Section of the British Association at Montreal, said, regarding electric telegraphs on land, that there are 86,000 miles in the British Empire, or nearly one-fifth of the sum total for the world. It is remarked that the telegraphs in Australia—26,000 miles—are exactly equal to those in the United Kingdom. But in illustration of the difference between an old and a new country there are 31,000,000 of messages yearly in the United Kingdom, and only 5,000,000 in Australia. In other words, the telegraph does six times as much in the old country as in the new. Similarly in the United States, the length of telegraph—121,000 miles—is amazing; but the messages are only 34,000,000—just in excess of those in the United Kingdom. In other words, the work is more than four times as heavy in the United Kingdom as in the United States. Besides the land telegraphs, there are submarine cables in the world with the surprising length of 105,000 miles. Of these the greater part belong to the British Empire.

"Let Knowledge grow from more to more."—ALFRED TENNYSON.

Only a small proportion of Letters received can possibly be inserted. Correspondents must not be offended, therefore, should their letters not appear.

All Editorial communications should be addressed to the EDITOR OF KNOWLEDGE; *all Business communications to the* PUBLISHERS, *at the Office, 74, Great Queen-street, W.C.* IF THIS IS NOT ATTENDED TO DELAYS ARISE FOR WHICH THE EDITOR IS NOT RESPONSIBLE.

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TEA-DRINKING.

[1411]—I have taken the advice of Mr. Williams, and at once commenced the experiment of weaning myself from the "drug." Should you deem it of sufficient interest to your readers, I will, in a few weeks, give them the result of my experience.

In the meantime, if Mr. Williams would fill up the omission in his article (as a reply to my letter), and state the nature of the mischief to be apprehended and its symptoms, I believe it would serve to arrest the attention of a large proportion of the readers of KNOWLEDGE who may still be waverers. A. GAUBERT.

A VERY OLD TRICYCLE.

[1412]—Truly there is nothing new under the sun. In KNOWLEDGE, No. 150, I read an account of a modified tricycle called the "Coventry Chair." Soon afterwards I found in an old book an account of the oldest sociable. This old book, called "Recreations in Mathematics and Natural Philosophy," was written by James Ozanam in 1694, improved by John Steven Montucla about 1754, and finally translated from the French, and further improved, by Charles Hutton, in 1803. After describing two invalid chairs, in which the invalid grinds himself along by means of handles, the translator goes on to say, "The other carriage, *as Ozanam says*, was moved by a boy seated behind, who trod alternately with his feet on two movable treadles. These treadles, in rising and falling, moved two pieces of wood fitted into toothed wheels fixed to the axis of the large wheels; but this mechanism is so badly explained by Ozanam, both in the description and the figure, that no one can understand it. For this reason we have thought proper" to say nothing more about it. PERCY MAJOR.

VACCINATION.

[1413]—Permit me to state a few facts relating to the above important subject. My father had three brothers and three sisters, all of whom were marked more or less. The women were entirely disfigured. My father had six children, all vaccinated. Not one of us had a single mark. The family has spread out widely, for I could count on my fingers fifty or sixty first, second, and third cousins. As far as I can ascertain, not one of them is marked. Let all those who have passed what we consider the limit of human life—let them look back, and I think they will find that mine is not an exceptional case. As to the number of deaths, I am not competent to give an opinion; but, in the very lowest classes, half the children born die under six weeks. Of course, it is *vaxination* that kills them. We have always more mouths than we can fill, but, as a painter, I do not like to see God's image disfigured.

A VERY OLD MAN.

MIND AND BRAIN.

[1414]—In the interest of truth only I should like to reply to Mr. Perrin's remark on Büchner's "force and matter." I certainly take thought to be an "effect" of stimuli passing through the brain-cells, as much as I take "colour" to be an effect caused by light passing through a prism. If, therefore, I have a right to say "colour" is "changed light" by the action of the prism, so I am right in saying stimuli vibrations or simply motion changed by the

XUM

action of the brain-cells is motion, *i.e.*, changed motion, *i.e.*, thought. In this sense only I understand Büchner to say, "thought is motion."

As to the power which determines the nature of the molecular changes, I take it to be the simple force of circumstances in conjunction with the nature, power, or capacity of our brain-cells. Just as different light, such as star, moon, or sunlight, produces different colours in passing through a prism (?) or through various sorts of glass or in different positions, so will, say, different kinds of stimuli produce different thought in different brains. For instance, a lecture on geology or astronomy would produce different kinds of thought than one on theology, &c. F. W. H.

THOU DUST!

[1415]—We appear to be threatened with a recrudescence of the sunset phenomena of last year. May I venture to suggest to the members of the Krakatoa Committee, through the medium of KNOWLEDGE, that even if they abandon the volcanic theory, they need by no means abandon the hope that the cause is a purely terrestrial one.

During the summer people go from home; in their absence the carpets are beaten, the fine dust rising into the atmosphere produces the observed effects; the colours are intensified by the fragments of dyed wool. *Voilà tout!*

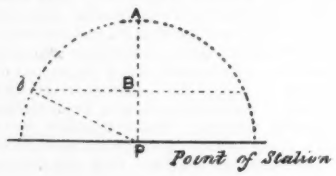
One slight apparent difficulty remains, viz., an explanation of the fact that these effects have only been noticed recently; but a committee whose ability easily coped with the fact that the glow from the dust was seen long before the eruption will doubtless readily dispose of such a trivial and captious bit of criticism. F.G.S.

[It seems to me that there is as much—or as little—to carp at in "F.G.S.'s magnificent theory as there is in that held by the R.S. Committee.—ED.]

FALSE PERSPECTIVE.

[The following letter was inserted in our last issue, but the diagram was inadvertently omitted. We therefore repeat the letter in its complete form.—ED.]

[1399]—If I do not trespass too much on your space and patience, I shall be glad if you will kindly insert the following in answer to your correspondent, "J. H. D." (No. 1386.)



If an object at A appears smaller than a similar one of equal size at B, *because* it is further off, so likewise, and for the same reason, will it appear smaller than B when it is moved to *b*.

The painter must depict things as they *appear to the eye;* it is for the sculptor to represent them as they exist in nature.

R. JONES.

[1416]—I fear my letter (1399) without its accompanying diagram, which has been, I presume, accidentally omitted, will not be very readily understood. I do not purpose troubling you with any further remarks on *False Perspective*, but shall be obliged if you will kindly print this, my final answer to "Eye Witness," "Old Draughtsman," and others who have taken part in the discussion.

"Eye Witness" is right—the horizontal and vertical lines will, doubtless, have vanishing points, which if not quite so far off as the nearest fixed stars, are, nevertheless, sufficiently remote to render their inclination *practically* inappreciable. If "Eye Witness" will refer to my former letters he will perceive that the drift of them has been to establish the fact, that when an observer is so placed that he can see a portion of *two* sides of a rectangular solid, the top and bottom edges of these sides will be seen to trend away in the manner I have described.

"Musafir" objects that my line of posts, if produced both ways, would converge to the right and left. "Old Draughtsman" (in letter 1288) furnished a sketch of a portico whose columns from the centre one right and left diminished in height very rapidly indeed. The effect was certainly peculiar, but *theoretically true to Nature*, although the diagram in question was manifestly intended to afford a sort of *reductio ad absurdum* proof of the fallacy of my own views. If "Old Draughtsman's" grotesque presentment did in any degree answer its inventor's purpose, it was, I fancy, because the details of the drawing were so monstrously inartistic and unscientific in their exaggeration. R. JONES.

Sept. 19, 1884.

[1417]—I have read attentively all the letters on the above subject which have appeared in your columns, and have several times been on the point of writing one myself, but have hitherto refrained. But, after the letter of "An Old Draughtsman" in your last number (150, p. 224), I would like, with your permission, to say something about it. The theory of "A. O. D." that the picture plane can assume other positions than at right angles to the line of vision (or direction in which the spectator looks) is surely utter nonsense. Taking Q Q (see his first figure) as the position of the picture plane, he makes out that the post *f* must be drawn about twice as high in the picture as the post *a*. (A *a* is retained in all his examples as the direction of vision.) Now, let readers produce the line *f a* to the right of *a*, and place a post, say *g*, as far to the right of *a* as *f* is to the left. Join A *g*, produce Q Q to cut A *g* in *n*. The distance of *n* from A *g* will give the distance from the post *a* or *f* in his second figure, at which it has to be drawn to show its apparent size in the picture. Draw it between *z z* and eye of spectator, A. It will be about half as long as *z z*, or one-fourth of *y y*. Call it *n n*. It seems, then, that the posts *f* and *g*, of equal height, placed at equal distances from the spectator, and at equal distances to the left and right of A *a*, the direction of vision, may be represented in a picture by lines in the proportion, say, of 4 to 1. Such a picture would be much after the style of the distorted image which one sees of one's face on looking into a silver spoon or a teapot, at the same time turning the head round a little. Surely "A. O. D." is making fun. It is quite true that Q Q *may* be used as the position of the picture plane, but then the spectator must turn somewhat round, so as to look in a direction at right angles to Q Q, which, of course, alters the whole case. Taking the problem as it stands, the only possible position of the picture plane is parallel to *a f*, that is, at right angles to the direction of vision A *a*. How would "A. O. D." represent the post *f* in his picture if his picture plane Q Q were inclined at a somewhat greater angle than represented, so as to make it pass *through* the line of posts, or behind *f*?

With regard to R. Jones's initial difficulty about the drawing of a cube, of which two sides are seen, one, parallel to the picture plane, being represented by a square, it may be remarked that elementary text-books on perspective show how to place, say a cube, in every part of a picture, and in all positions. But each of these is only a small object in a large picture, and seldom in the centre. In order to get the representation of a cube which R. Jones expected, the cube must be placed directly opposite the spectator, with both visible sides forming angles with the picture plane. It will then occupy the centre of the picture, and both visible sides will vanish. The same will happen with R. Jones's original cube (which is to the left of the direction of vision) if the spectator turns round and looks straight at it. Of course, this changes the direction of vision, at right angles to which a new picture plane must be drawn. We will then have, as before, both sides vanishing.

A curious fact may be mentioned about the perspective representation of a sphere not in the centre of the picture. The rays of light from all parts of a sphere to the observer's eye form a cone. If the sphere is some distance to the right or left, this cone will be cut obliquely by the picture plane, the section being an ellipse. A sphere so placed will therefore be correctly represented in the picture by an ellipse, and not by a circle, as one would at first suppose. STARCH.

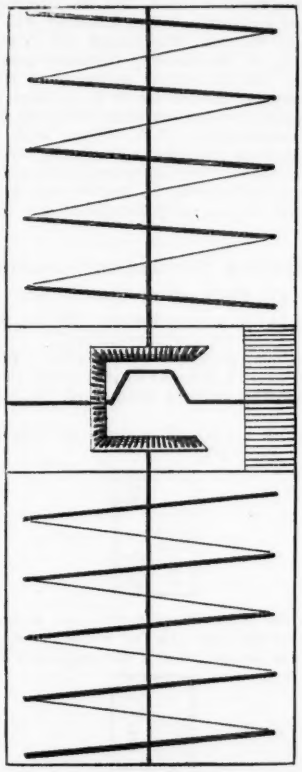
AËRIAL LOCOMOTION.

[1418]—The interest with which I read your recent articles on aërial flight was not unmixed with curiosity, and ultimately, I may confess, with some disappointment at the absence of all reference to one possible solution which has of late years obtruded itself on my speculations on this subject. The method to which I allude is that of *ascent into*, and *continued support in*, the air by the help of a *screw-shaped fan*. I do not know whether it has ever been tried, nor, indeed, can I call to mind any distinct proposal of this kind: yet it appears to have elements of success which might well tempt mechanical invention, and must surely have done so.

If a screw can be made large enough, light enough, and strong enough to *raise* the weight of a man, in addition to the machinery and reservoir of power requisite to turn it at the proper speed, the problem of aërial locomotion will surely be solved; for it will obviously be only necessary to *incline the axis* of the screw in order to obtain lateral motion.

I imagine there can be no doubt as to the *meaning* of what I have above suggested; it only remains for those whose practical acquaintance with such things, and whose theoretical powers of insight are sufficiently recognised to pronounce on the prime question whether an archimedean screw, revolving in air, could be made large enough and strong enough, and could be rotated with a sufficient velocity, to produce the necessary lifting power. It will, I think, be admitted that the *prima facie* likelihood is considerable, although something more than that is needed to stimulate experiment.

There is one point on which I must add a caution. The resistance of the air, due partly to friction and partly to the pitch of the screw, must find some sufficient opposition in the machine itself, otherwise the latter will turn in the contrary direction. This



suggests a second fan, with a contrary pitch—or a subsidiary fan devoted solely to counteraction. The relative advantages of these, and the disposition generally of the fans with respect to the car, are points into which I will not enter, further than to hazard the opinion that the greatest economy would be attained by two equal screws of opposite pitch, revolving in opposite directions, and having their axes in one straight line.

The accompanying diagram, without pretending to be a design for a flying machine, is intended to show how the difficulty glanced at above, can be entirely met. Power is supposed applied either through the crank or by a coiled spring. If two or more screws support a platform, there is no need for other counteraction than their own. J. HERSCHEL.

LETTERS RECEIVED AND SHORT ANSWERS.

[Before these lines meet the reader's eye, I shall have left England for a month's very sorely needed rest. Correspondents must hence bear with me if the replies in this column are during that period practically confined to an acknowledment of the receipt of their communications.]—DOROTHY FORSTER. I know of nothing exactly answering your description; but you might try Miss Yonge's "Aunt Charlotte's Stories from Bible History," any of the volumes of the "Line Upon Line" series, or even "Pinnock's First Steps to Bible and Gospel History." You had better write to Moffatt & Paige, Warwick-lane, London, on the subject of cheap historical wall pictures. They are the likeliest people I know of to publish such things—if, indeed, they are published. In connection with the Kyrle Society, apply to Miss Hill, 14, Nottingham-place, London, W.—W. G. The lines you quote are from a mediæval drinking-song in Leonine Latin, and may be construed, "I mean to die in a tavern; expiring with the wine at my lips (as the English singers say) May the Almighty be propitious to this sot." Truly, not a very edifying sentiment!—L. A. W. Looking through an astronomical telescope is not injurious to the sight, especially if you can teach yourself to do it (as you soon may) with the other eye open. Using the eyes alternately, too, is good. Look in Map VII. of "The Stars in their Seasons" for ζ and η Herculis. Draw an imaginary line from η to ζ, and one-third of the way along it you will find the cluster you refer to. The period of Encke's comet is not 5 but 3·3035 years. It was, I fancy, last seen by Tebbutt, in August, 1878. Halley's comet will not return until 1911. Certainly Vesta, Juno, Ceres, and Pallas can be seen with a 2½-inch object-glass; Vesta sometimes even with the naked eye. They are difficult to distinguish from fixed stars merely by their aspect.—W. G. WISEMAN, F.R.G.S., on opening a duck's egg the other day, discovered, in addition to a perfect yolk, another small egg, about the size of a pigeon's, with a hard shell. Will any embryologist explain this not very common phenomenon for his benefit?—COPE WHITEHOUSE offers to furnish gratuitously to any author or publisher clichés of his woodcuts of Staffa printed in his paper read before the geological section of the British Association at Montreal.—B. O'REILLY. In the morning. A table-lamp, certainly.—WAVE. From the friction of their lower parts against the beach as they approach the land. There is no "easy" way of working out moon-rise, which, in any accurate form, is a very complicated piece of calculation. Of course, it must be computed afresh for each locality. It is given for London in Whitaker's Almanack, but the vol. for 1885 is not yet out.—F. L. ARMITAGE. See Lommel's "Optics and Light" in the International Scientific Series.—T. R. C. sends me a prospectus of "The Society of Science, Letters, and Art of London," which seems to give concerts, conduct examinations, grant hoods, gowns, and decorations or badges (or, I suppose, the right to wear them), furnish lecturers, &c., for literary, musical, and scientific evenings, and require funds to meet expenses. F.R.S.L. means Fellow of the Royal Society of Literature.—A. S. ORR. "Five of Clubs" is, unfortunately, at present on the other side of the Atlantic.—A. ROBERTS. In these latitudes, just prior to the spring equinox, the inclination of the ecliptic to the horizon is very considerable. Moreover, the moon's orbit is inclined some 5° to the ecliptic, so that she may be 5° north of that again, and the line joining her centre and that of the sun seemingly nearly perpendicular to the horizon after sunset. Hence the diameter passing through her cusps lies pretty nearly horizontal when she is very young, and she seems to "lie on her back" in the western evening sky. The idea, however, that this is a cause or sign of rain is as utterly baseless as that her so-called "changes" affect the weather.—H. C. S. wants details and an explanation of the Berkeley-square Ghost. I am unfamiliar with either myself. Can any reader furnish the necessary particulars?—J. B. FINDLAY. The information contained in every one of the astronomical works advertised by the Messrs. Longmans, on p. viii. of the advertisement sheets in KNOWLEDGE, for Sept. 19th, is brought up to the very latest date. See, too, Ball's "Astronomy," by the same publishers, Newcomb's "Popular Astronomy," published by Macmillans, or Sir Edmund Beckett's excellent "Astronomy without Mathematics," issued by the S.P.C.K. The hypothesis that Alcyone is the centre of the visible universe (a mere fancy of Mädler's, of which Sir John Herschel at once pointed out the improbability) has been definitely shown to be groundless by the study of the proper motions of the stars in different regions of the heavens. The latest and most trustworthy theories on the subject of variable stars are those of Professor Pickering. See the "Universe of Stars," for the structure of the heavens. I think that Todhunter's books on Trigonometry are, perhaps, as good as any you can get; but Spherical Trigonometry is not an easy subject to get up without a tutor.—A. J. HARVEY. I doubt if there is a single astronomical reader of KNOWLEDGE who is ignorant of Schwabe's discovery of the periodicity of sun-spots. His period, however, has since been shown to be erroneous.—T. K. H. Received. No time to deal with your charming little problem now.—PRO LIBERIS. See reply to "Anonymous" on p. 247.—E. L. TAYLOR, S., K. H., S. B. PARTRIDGE, G. D. EVANS, F. S. THOMPSON, W., and many others who send answers to the Figure Puzzle. Thanks; but the two letters printed contain at once a reply to and an explanation of the theory of the question.—COLONEL HERSCHEL. Your interesting letter was, of course, marked for insertion. Replies in this column are mainly confined to correspondents whose letters are *not* intended to appear.—DR. E. GROTH. I failed to lay my hand upon the proof to which I referred, and am very much too busy at this instant to be able to devote an hour or two to hunting it up. Meanwhile may I suggest for your consideration the millions of years which it must, *ex ne*-

sitate, occupy for the fragments of any single body (which must have *solidified* before disruption) to diverge into such wholly different orbits as those described by the planetoids, the very wide scattering of their nodes, and their sorting into separate groups, and invite you to study what Sir William Thomson says as to the limits of the antiquity of our solar system. Forgive me for saying that you seem to resent the assumption that Olbers was wrong, as though you wish to make a personal quarrel of the matter! If you insist on believing that the 250 known (and *x* undiscovered) bodies travelling between Mars and Jupiter in such very diverse orbits, are fragments of one large one, I am not concerned to undeceive you.—C. E. Doyle. The "Notes on Mapping" will be resumed later on. There is a great press of matter on our columns just now.—Telegraphist. The series of articles on electrical measurement did not cease where you imagine, but was continued into Nos. 75 and 77; and the articles, so far as they went, were complete. The interest and importance attaching to the subject are certainly great, and Mr. Slingo will probably further augment the series at an early date; at least we hope space will permit him to do so.

Our Chess Column.

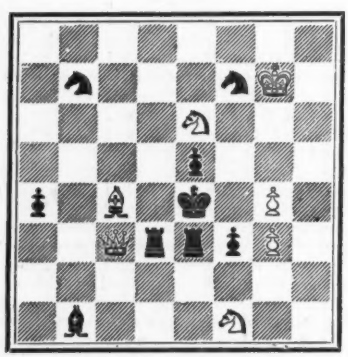
By Mephisto.

SELECTED PROBLEM, No. 130.

By E. N. Frankenstein.

(A masterpiece.)

Black.



White.

White to play and mate in three moves.

CORRECTION.

Problem No. 129, p. 248.

A black Pawn ought to be placed on Black's KKt4.

SOLUTIONS.

Ending p. 228.

1. R × P P × R or Q × R
2. B × Kt Q × B Q × Q R × Q
3. Q to K8(ch) mate B × Kt and wins
   or wins

If Kt × Q 2. R × R mate.
If R to QBsq 2. R to Q4 and wins.

Problem No. 128.

By Clarence.

1. Q to B7, B × Kt. 2. Q to R7 mate
   Kt × P 2. P to B3 „
   B to B5 2. Kt to B3 „

Carlton Chess Club, 12, Bell-street, Edgware-road.

Sir,—Being desirous of having a Chess club under the above name, we should be glad if you would help us by giving us a few simple rules and hints as to how it should be conducted, and how we should proceed when challenging another club. Can you tell us the names of any minor Chess clubs we could play for a start? We have several very good players. Carlton C. C.

[Elect committee and officers, draw up the usual rules, or copy those of the City of London Chess Club, which you may get on application. Having formed the club, arrange a handicap tournament for the winter season, in which, if the number be not too large, each player (properly handicapped) plays one game with every other man. As to inter-club matches, there has been a meeting of the secretaries of London C. C. this week, at the Ludgate Circus C. C., at Oliphant's Café in St. Bride-street, for the purpose of settling matches for this season, but we have no doubt that a written or personal application to the secretary will give you any particulars you may require. The nearest club in your neighbourhood is the C. C. of the Railway Clearing-house in Seymour-street. Perhaps, though rather strong, they might accept a challenge. Any further information as to conduct of a club you will, no doubt, obtain from the courteous secretary of the City of London C.C., Newgate-street, E.C. If you wish your Club to prosper, give it as much publicity as you can by sending notices of your doings to the press. We understand that a new weekly paper—the *Weekly Echo*—will shortly be started with a Chess Column, a part of which will be especially devoted to the London Clubs.—Mephisto.]

ANSWERS TO CORRESPONDENTS.

*** *Please address Chess Editor.*

F. J. D.—Thanks for communication. We are pleased to hear from you again. Have you anything original?

A. E. R.—Problem received, with thanks. Pray excuse the alteration, as otherwise 1. Q to Kt sq (ch) would solve it.

W. Hanrahan.—The author's solution of No. 127 is the most decisive.

J. K. Milne.—You are mistaken about the rule of Pawn takes Pawn in passing. Supposing—

In this position the white Pawn moves two squares. Then the black Pawn has the right to take the white Pawn, as if the latter had only moved one square. But if the position is like this:—

then the white Pawn can advance two squares, and the black Pawn has no right of taking the white Pawn.

Correct Solutions received:—Problem No. 127: S. B. C.; No. 128: J. K. Milne, M. T. Hooton, A. W. Overton. Problem No. 129 solved by Geo. W. Thompson, H. A. N., W.

W.—We are very much afraid you have cooked No. 129. Your solution is as complete as it is correct; pray note correction above.

Geo. W. Thompson, S. B. C.—Solutions incorrect.

H. Smith.—The proposed tournament at the Divan will be open to all comers.

Contents of No. 151.

	Page
Our Two Brains. By Richard A. Proctor	229
An Aërial Propeller. (*Illus.*)	230
Pleasant Hours with the Microscope. (*Illus.*) By H. J. Slack	230
Statistics of Barataria. I. By Grant Allen	231
The Workshop at Home. (*Illus.*) By a Working Man	233
The Earth's Shape and Motions. IV. Determining the Shape of the Earth (*Illus.*) By R. A. Proctor	234
Dickens's Story left Half Told. By Thomas Foster	235
Emigrants' Prospects in America. By W. R. Browne	236
Electro-Plating. XI. By W. Slingo	237
Zodiacal Maps. (*Illus.*) By R. A. Proctor	238
The British Association of Science	239
International Health Exhibition. XVI.	241
Dr. Kinns and his Friends	242
Editorial Gossip	243
Reviews	243
Miscellanea	244
Correspondence	245
Our Chess Column	248